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Canadian Field Naturalist

1917. Vol. XXXI. 1918.

THE

OTTAWA NATURALIST

Being Volume XXXIII. of the

TRANSACTIONS

OF THE

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OTTAWA FIELD-NATURALISTS' CLUB

Organized March, 1879. Incorporated March, 1884.

The Ottawa Field-Naturalists' Club

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THE OTTAWA NATURALIST

VOL. XXXI. APRIL, 1917. No. 1.

REPORT OF THE OTTAWA FIELD-NATURALISTS' CLUB, FOR THE YEAR ENDING MARCH 20, 1917.

General Statement.

The Ottawa Field-Naturalists' Club has continued its activities in interpreting and diffusing information on natural science during 1916-1917. The British Government has just increased the appropriation for scientific work in Great Britain to more than five times its total previous appropriations, thus recognizing the importance of the work carried on by such organizations as the Ottawa Field-Naturalists' Club. These organizations are now vitally necessary since the scientific method has been proven to be the only way by which we may hope to solve such problems as the conservation and increase of our crops and forest products, our stock and fish, game, and fur resources, our mineral resources, and our public health.

This work of the Club has been accomplished chiefly by three means—the publication of The Ottawa Naturalist, now starting its thirty-first year and volume, a series of field excursions, and a course of lectures.

Eleven members have resigned, but as thirty-two new members have been elected, there is a net gain of twenty-one members, the total membership now being three hundred and forty-six. The Club is organizing a campaign for increasing its membership.

His Excellency, the Duke of Devonshire, has expressed his interest in the Club by consenting to become its Patron.

The library of the Club, a large and valuable collection of nature books and periodicals, has been turned over to the Carnegie Library, Ottawa, which will catalogue it and make it available to the entire public. Accessions to the Club library will now be turned over to the Carnegie Library.

Trust Funds.

A trust funds committee has been appointed to receive and administer additions to the trust fund of the Club.

THE OTTAWA NATURALIST.

THE OTTAWA NATURALIST, the official publication of the Club, has been issued under the continued editorship of Mr. Arthur Gibson. A fire which occurred in the office of the printers, The Rolla L. Crain Company, destroyed the entire November edition and all the engravings, but The Dadson-Merrill Press have since taken over the printing of the publication and are rapidly restoring the interrupted schedule. In order to interest a larger number of citizens the Council has decided to include in each issue items of popular and scientific interest, more particularly notes that give practical natural history information. An effort is being made to secure more articles of general interest without neglecting to supply that great need of science—a place of publication for its discoveries.

Among the more popular papers published during the year the following may be mentioned:

The Formation of the Great Plains of Northwestern Canada. By D. B. Dowling.
The Use of Wild Plants as Food by Indians. By Tom Wilson.
American Insect Galls. By E. P. Felt.
Birds of Lake Onigamis Region, Que., and Algonquin Park, Ont. By John M. Cooper.
Notes on Some Ottawa District Plants. By W. H. Harrington.
Notes on the Feeding Habits of Two Salamanders in Captivity. By C. M. Sternberg.
Concerning Some Ontario Crayfishes. By A. G. Huntsman.
My Bird Houses. By C. L. Patch.
Are Our Forests Vanishing. By R. H. Campbell.
The Barn Owl Nesting in Southwestern Ontario. By W. E. Saunders.
Sea Squirts. By E. E. Prince.
The Sharp-shinned Hawk. By W. J. Brown.
New Sphaeriidae, a family of bivalve Molluscs which are remarkably abundant near Ottawa, and form no small part of the food of many fishes and birds.
Bird Notes. By F. C. Hennessey.

Various small notes on birds, butterflies, mushrooms and flowers were also published.

Among the more technical scientific papers may be mentioned:

Some Notes on Fossil Collecting and on the Edrioasteroidea. By G. H. Hudson.
A Preliminary Paper on the Origin and Classification of Intraformational Conglomerates and Breccias. By R. M. Field.

Paedeumias and the Mesonacidae, with description of a new species, having at least forty-four segments, from the Lower Cambrian of British Columbia. By L. D. Burling.

Comarocystites and Caryocrinites. By A. F. Foerste.

On Cheneosaurus tolmanensis, a new genus and species of Trachodont Dinosaur from the Edmonton Cretaceous of Alberta. By L. M. Lambe.

Notes on the Bottom Environment of the Marine Invertebrates of Western Nova Scotia. By E. M. Kindle.

EXCURSIONS.

The field excursions are advertised in the papers so as to be within the reach of everyone, not only Club members but the general public. The expense is slight, seldom more than street carfare. Scientific men, both members of the Club and others at the request of the Club, attend the excursions to direct interest and answer questions.

In the spring of 1916, five excursions were held according to the programme published in the April number of THE OTTAWA NATURALIST:

No. 1, May 6. Rockcliffe and the vicinity of McKay's Lake. Subject, Geology. Leader Dr. E. M. Kindle of the Geological Survey.

No. 2, May 13. Cache or Catfish Bay, west of Hull. General Zoology. Leaders: Mr. G. A. Millar of the Normal School, C. M. Sternberg, and F. W. Waugh.

No. 3, May 27. Fairy Lake and vicinity. Subject, Botany. Leader, F. W. Waugh.

No. 4, June 10. Aylmer Park and vicinity. Subject, General Zoology. Leaders: C. Patch, F. W. L. Sladen, and F. W. Waugh.

No. 5, June 17. The Experimental Farm. Subject, Horticulture. Leader, Mr. W. T. Macoun.

In addition to the usual series of spring excursions, the Club organized an autumn excursion to Fairy Lake on which botany was the centre of interest, special attention being paid to the different kinds of seeds. The excursion differed in this way from the usual spring flower study. The announcements for these excursions were made through the daily press and the attendance reached as high as thirty. An effort will be made during the coming season to lead more of the resident members of the Club to avail themselves of this interesting way of getting acquainted with the common things of Nature.

LECTURES.

The lectures are planned to represent all branches of natural science, and were given by scientists from several departments of the Government service. They develop an appreciation of the scientific

work of the Government, but are intended chiefly to increase a love for natural history and to lead to a greater use of scientific method and scientific facts in our every day life.

The following programme of illustrated lectures was carried out during the 1916-1917 season:

Dec. 16, 1916—"A Journey Through Space." By Dr. J. S. Plaskett, Dominion Observatory, Ottawa.

Jan. 9, 1917—"Are Our Forests Vanishing—What are we doing to Perpetuate Them?" By Mr. R. H. Campbell, Director of Forestry, Ottawa.

Jan. 23, 1917—"Our Winter Birds." By Dr. M. Y. Williams, Geological Survey, Ottawa.

Feb. 6, 1917—"The Animals of Arctic Canada." By Dr. R. M. Anderson, lately in charge of Southern Scientific party of Canadian Arctic Expedition.

Feb. 20, 1917—"Fishes and the Fishing Industry." By Mr. Andrew Halkett, Naturalist, Naval Department, Ottawa.

Mar. 6, 1917—"The Conservation of Wild Life in Canada." By Dr. C. Gordon Hewitt, Dominion Entomologist, Ottawa.

Mar. 20, 1917—Presidential Address: "Recent Archaelogical Work in Canada." By Mr. Harlan I. Smith, Geological Survey, Ottawa.

The first lecture was held at the Observatory and the members were given an opportunity to look through the telescope. All the others were held in the Ottawa Normal School. The address by Dr. Dr. J. S. Plaskett on "A Journay Through Space," was given before the People's Forum on the evening of February 25, and Dr. Plaskett then had an audience of nearly 1400 people, many times the number who heard him previously. The increased audience may be due partly to interest aroused by the press report of the previous lecture. However, our interest is in furthering the aims of the Club rather than the Club itself and we are glad that so many people had the opportunity of hearing one of our lectures.

Many members of the Club also gave lectures to public school, Collegiate, and Normal students, and to the Boy Scouts and Girl Guides.

Submitted on behalf of the Council,

L. D. BURLING,
Secretary.

TREASURER'S STATEMENT, 1916-17.

Receipts.

Balance from 1915-16		$ 13.70
Membership fees:		
Arrears	$ 57.00	
1916-17	181.50	
In advance	18.00	
		256.50
THE OTTAWA NATURALIST:		
Advertisements	$84.30	
Copies sold, one	.15	
		84.45
Authors Extras sold		28.43
Donation, Dr. H. M. Ami		10.00
Provincial Government Grant		200.00
		$593.08

Disbursements.

THE OTTAWA NATURALIST:		
Printing 8 Nos.	$317.18	
Illustrations	58.95	
Printed Envelopes	24.70	
Postage	16.49	
Editor	50.00	
		$467.32
Authors Extras		52.00
Lecture Expenses		18.72
Miscellaneous Printing, Stationery, etc.		13.20
Postage and Bank Exchange		24.01
Credit Balance		17.83
		$593.08

Examined and found correct.
J. BALLANTYNE,
E. C. WIGHT, *Auditors.*

G. LELACHEUR,
Treasurer.

PROGRAMME OF FIELD EXCURSIONS

SPRING AND SUMMER SEASON, 1917.

The interest shown in the Saturday afternoon field excursions conducted by the Club during 1916 and preceding seasons has led to a still greater effort for 1917.

The primary purpose of the outings is to cultivate an acquaintance with the fauna and flora of the district surrounding Ottawa and thereby increase the general interest in natural science. Local specialists in various branches have always shown a readiness to assist and the present season will be no exception.

You can assist in the success of the excursions by attending and bringing your friends. Non-members will be cordially welcomed.

A programme for the autumn will be announced later.

May 12—Geological; Mechanicsville to Britannia, along the Ottawa; place of meeting, the western end of Somerset street bridge; time 3.00 p.m.

May 19—Zoological; Tetreauville to Hull, along the Ottawa; place of meeting, the station (suburban electric) at the Chateau Laurier at 2.30 p.m.

May 26—Botanical; Gatineau Point to Hull; place of meeting, Rockcliffe, second stop past the tea-house (just opposite Gatineau Point); time, 2.30 p.m.

June 2 (King's Birthday)—An all-day excursion has been planned for this date to Stittsville and vicinity; object, general nature study; place of meeting, Central Station at 9 o'clock a.m. (Train starts at 9.35). Mr. Hutton of the Geological Survey Photographic Department will furnish any assistance desired to those interested in photography. Bring cameras and lunch.

June 9—Entomological (Insect life); the Experimental Farm; place of meeting, the station at the Farm; time, 3.00 p..m

June 16—Zoological (land, water and fossil molluscs); McKay's Lake, just east of Rockcliffe Park; place of meeting, the bridge opposite the lake; time, 3.00 p.m.

June 23—Botanical (trees and shrubs); Aylmer Park and vicinity; place of meeting, the station at Chateau Laurier at 2.00 p.m.

June 30—General nature study; Black Rapids, on the Rideau; place of meeting, the steamboat dock near the Central Station at 1.00 p.m. Bring your cameras.

LITTLE KNOWN MIDGE GALLS OF CERTAIN COMPOSITES.

BY E. P. FELT, ALBANY, N.Y.

The writer published in 1911* a tabulation of American Midge Galls and since then a number of new ones have been discovered on plants which are likely hosts of additional species. It is the purpose of these notes to call attention to some interesting analogies and to point out promising lines of investigation.

The occurernce on the gum plant or tarweed, *Grindelia*, and on *Gutierrezia*, of the typical blackened, carbonaceous tissue so conspicuous in the oval black blister galls of the narrow-leaved goldenrod, is most interesting, especially as all three are produced by midges belonging to the genus *Asteromyia*. The first is the work of *Asteromyia grindeliae* Felt, the second of *A. gutierreziae* Ckll., and the third of the much better known *A. carbonifera* Felt. The gall of *A. gutierreziae* Felt differs from those of the other two species, in that it consists of slight enlargements of the slender stems instead of a development upon the leaf. Both *Grindelia* and *Gutierrezia* are known to support bud or flower-inhabiting species of *Rhopalomyia*. *Ericameria* also has its bud inhabitant, *Rhopalomyia ericameriae* Felt, which produces a small rosette bud gall, really aborted branchlets. It is very probable that the related and rather common *Sideranthus* supports one or more gall midges.

The various wormwoods or sage-brush of the western plains, Artemisias, support an interesting and presumably only partly known fauna. Two genera, *Diarthronomyia* and *Rhopalomyia* find very acceptable conditions on these plants, particularly the former, a genus which appears to confine itself largely to *Artemisia* and the related *Chrysanthemum*. In order to facilitate the discovery of new species on *Artemisia*, a tabulation of the known galls, including those of associated forms, is given below.

INSECT GALLS ON WORMWOOD OR SAGE-BRUSH ARTEMISIA.

ARTEMISIA CALIFORNICA.

Irregular, lobulate, woolly masses, apparently arising from lateral buds and frequently confluent, the individual galls with a diameter of about 4 mm. ----------*Diarthronomyia floccosa* Felt

Subconical, thin-walled, obliquely-set, brownish or reddish leaf galls with a length of 1.5 mm., and a diameter of .5 mm.

Diarthronomyia californica Felt

*Econon. Ent. Journ. 4:451-75.

ARTEMISIA CAUDATA.

Oval, woolly, apical or lateral bud galls with a diameter of 1 to 1.5 cm. and consisting of a series of oval cells, each with a length of about 2 mm. and with numerous long fibers--Woolly wormwood gall, *Rhopalomyia ?alticola* Ckll.

ARTEMISIA FORWOODII (?CANADENSIS).

Globular, woolly galls with a diameter of about 1 cm.
Woolly wormwood gall, *Rhopalomyia alticola* Ckll.

ARTEMISIA FRIGIDA.

Fusiform flower or leaf bud galls, length 4 mm., also occurs on *A. filifera* ----------*Rhopalomyia betheliana* Ckll.

ARTEMISIA GNAPHALODES.

Irregular, lobulate, polythalamous, white, pubescent gall, diameter 1 cm. ----------*Rhopalomyia gnaphalodis* Felt.

ARTEMISIA HETEROPHYLLA.

Ovate, thin-walled, oblique leaf galls, length 1 mm., also breeds in apparently normal flower buds---*Diarthronomyia occidentalia* Felt.

ARTEMISIA SP. (WORMWOOD).

Deformed flower heads, length 10 mm., diameter 5 to 6 mm.
Wormwood flower midge, *Rhopalomyia coloradella* Ckll.

Bud galls----------presumably *Asphondylia artemisia* Felt.

A bud deformation of black, globose or densely crowded filaments ----------*Eriophyes* sp.

Ovate masses of linear, modified leaves occurring on the branchlets, length of mass 1.5 cm., diameter 5 to 7 cm.---------*Eriophyes* sp.

Subconical, short-wooled, yellowish gray, axillary bud gall, length 2 cm., diameter 1 cm. ----------*Trypetid*

Globose, axillary, woolly bud gall, diameter 7 to 10 mm., the hairs grayish white, short and thick ----------*Trypetid*

ARTEMISIA TRIDENTATA (SAGE-BRUSH).

Oval, bud-like flower gall the size of a pea.
Rhopalomyia tridentatae Rubs.

Ovate, hard, thick-walled, yellowish brown bud gall, length 1.5 cm., diameter .8 cm. ----------*Trypetid.*

Flask-shaped or subconical leaf gall, length 4 mm., diameter 2 mm. --------Wormwood flask gall, *Rhopalomyia ampullaria* Felt.

Oval, grayish or almost black, solitary or clustered gall on the under side of the leaves, length 1.5 cm.
Diarthronomyia occidentalis Felt.

Globose, variable, monothalamous or polythalamous leaf, bud or rosette galls or a bladdery gall arising from the leaf, pubescence variable, dimensions 3 to 15 mm.-----*Diarthronomyia artemisia* Felt.

Subglobular, brown, spongy apical gall, diameter 1.8 cm., possibly identical with the preceding ----------*Cecidomyia* sp.

NOTES.

This number of THE OTTAWA NATURALIST begins a new club year and dues are, therefore, now payable. If all members will mail the dollar membership fee to the Treasurer, Mr. J. R. Dymond, Seed Branch, Dept. Agriculture, Ottawa, it will save his time and a considerable amount of postage.

Dr. John Stanley Plaskett, formerly in charge of the department of astrophysics in the Dominion Observatory at Ottawa, has been appointed director of the Dominion Astrophysical Observatory, which is being established at Victoria. The principal instrument of the observatory is a 72-inch reflecting telescope, the mounting of which is in place, and the mirror is nearing completion at the shops of the Brashear Company.

The U. S. Government makes larger appropriations for scientific research than any other nation, and the money has on the whole been used to advantage. The fact that the work there is mainly economic is not, altogether, a drawback. The difficulty has been that better provision was made for routine work than for exceptional performance. The present emergency has led to further large appropriations for scientific research, and we may hope that the truth expressed in the President's words "Preparation for peace is the best preparation for war" will lead to still greater efforts to promote science for the national welfare.

A fund of $25,000 has been raised as a nucleus for the purposes of organizing a Museum of Natural History in the city of Portland, Oregon. A similar movement has been started in Spokane, Washington, and it is hoped that the city of Spokane will in the near future have a museum specially devoted to the American Indians of that region.

Sir Alfred Keogh, director-general of the British army medical service, presiding at a lecture at the Royal Institute of Public Health on February 14, is reported in Nature to have stated that in France at that moment there were only five cases of enteric fever and eighteen cases of paratyphoid fever, with seventy or eighty doubtful cases. He attributed this result to inoculation, the general good health of the army, to good food, and in addition, to careful sanitation. The health of the army at all fronts was said to be better than the ordinary health of the army in peace-time.

The Dominion Government, by order in council dated December 28, 1916, appointed an interdepartmental advisory board on wild life protection for the purpose of formulating plans regarding the protection and use of the wild life—by which term is meant the furbearing and big game mammals, the wild fowl and other animal life—of the northwestern territories, and of advising in the administration of the Northwest Game Act and of the legislation under the recently ratified international treaty for the protection of migratory birds in Canada and the United States, and generally, for the purpose of advising it on questions relating to the protection of and use of wild life in Canada. The advisory board is constituted as follows: James White, Assistant to the Chairman of the Commission of Conservation; D. C. Scott, Deputy Superintendent General of Indian Affairs; Dr. C. Gordon Hewitt, Dominion Entomologist; Dr. R. M. Anderson, Geological Survey; J. B. Harkin, Commissioner of Dominion Parks. Mr. James White is chairman and Dr. Hewitt is secretary of the Board; Mr. White and Dr. Hewitt are also representatives of the government on the permanent consultative commission for the international protection of nature.

BRITISH GOVERNMENT GRANT FOR SCIENTIFIC RESEARCH.—When the establishment of a separate department of scientific and industrial research was announced in December last, Lord Crewe stated that the Chancellor of the Exchequer was prepared to advise the government to devote a sufficient sum to cover operations during the next five years on a scale which would provide four, or perhaps five, times as much for coöperative industrial research as had been spent for the whole purposes of research hitherto. We learn from Nature that the civil service estimates just issued include the sum of £1, 038,050 to the department of scientific and industrial research, being a net increase of £998,050 upon last year's amount.

A circular letter giving 39 generic names in Protozoa, Coelenterata, Trematoda, Cestoda, Cirripedia, Tunicata and Pisces, chiefly Linnaean, which have been proposed for inclusion in the Official List of Zoological Names, has been mailed to the leading scientific institutions, colleges, laboratories, etc., in various countries; in addition 20 copies have been sent to each commissioner for distribution in his own country. A copy will be sent to any person sufficiently interested who will apply to Dr. C. W. Stiles, Secretary to International Commission on Zoological Nomenclature, U.S. National Museum, Washington, D. C.

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NOTES ON THE LAND MOLLUSCA OF DE GRASSI POINT, LAKE SIMCOE, AND OTHER ONTARIO LOCALITIES.

By E. M. Walker, F.R.S.C., University of Toronto.

When the Royal Ontario Museum of Zoology was opened in the spring of 1914 it was our first aim to assemble such material as was available for the formation of a collection illustrating the Canadian fauna. One of the groups in which this material was found to be conspicuously lacking was the land Mollusca and to supply this deficiency the writer decided to spend a part of the summer of 1915 in making the nucleus of a collection of our local species of land snails and slugs.

I am not a malacologist and I am well aware that in collecting in an unfamiliar field one is sure to overlook many species, if the collecting is done without some previous knowledge of the fauna and of the habitats of its various members. I therefore endeavoured to familiarize myself with the subject as far as circumstances would permit and made an effort to determine each species as soon as possible after it was collected. Had this not been done there is no doubt that many of the more minute forms would have been overlooked.

The season of 1915 was unusually cool and wet and thus proved to be a very favourable one for land Mollusca. Most of the summer was spent at De Grassi Point, on the west shore of Cooke's Bay, Lake Simcoe, about three and one-half miles from the upper or southern end of the lake. A few days were also spent at Go Home Bay (Bushby Inlet), on the east shore of Georgian Bay, and some collecting was also done in the vicinity of Toronto and at Port Rowan and St. William's, near Long Point, Lake Erie. During the season of 1916 a number of species were collected by Miss Norma H. C. Ford in the vicinity of Toronto and she has kindly permitted me to include her records with my own.

As the greater portion of the collection was made at De Grassi Point and is believed to contain a nearly complete representation of the species found there it may be worth while to describe briefly the

general features of this locality in so far as they affect the character of the molluscan fauna.

The Lake Simcoe district differs considerably from that of Toronto in its flora and fauna, which is of a more northern character, due to its comparative remoteness from the modifying influence of Lake Ontario and its somewhat greater elevation, Lake Simcoe being about 475 feet above Lake Ontario. Whereas Toronto may be said to be on the edge of the Carolinian or Upper Austral Zone, Lake Simcoe is typical of the Alleghanian or Transition Zone. The shores of the lake are almost everywhere low and flat and in the vicinity of De Grassi Point are for the most part inclined to be more or less swampy. The existence of the "Point" is due to the presence of a somewhat higher area of boulder clay forming an angular prominence, the shores of which face north and east to southeast respectively. The clay banks rise abruptly to a maximum height of about ten feet near the apex of the prominence but gradually descend on either side to the usual low level.

The clay area is connected with the higher land farther from the lake by a sand-covered ridge, which follows a southwesterly direction roughly parallel to the lake shore for about three-quarters of a mile. On the southeast side of the ridge there is a gentle slope to the lake shore, while on the other side is an extensive area of low, densely wooded land, bounded on the north by the north shore of the "Point."

The tree growth of De Grassi Point consists of a mixture of deciduous and coniferous trees, presenting a considerable variety of forest types within a very limited area. The clay area is largely covered by a fine grove of red oak, particularly along the shore where the summer cottages are situated, while the characteristic trees of the sandy ridge, are red oak, white pine and balsam fir, although many other kinds are also present.

The southeastern slope is partly occupied by pastures but there is a considerable area of woodland, varying in character from a mixture of coniferous and softer deciduous trees, which prevail on the lower areas, particularly near the shore, to a typical hardwood forest on some of the higher parts of the slope. The prevalent trees of the former type are white cedar, balsam fir, aspen and balsam poplar, canoe-birch, elm, black ash, white spruce, etc., while in the typical hardwood areas sugar maple, beech, basswood, yellow birch and hemlock are the principal species, though many others occur. The extreme hardwood forest type is represented by a small area, wooded almost entirely with sugar maple and beech, with a scattering of other trees, such as butternut and basswood and having a very rich soil, as indicated by the larger size of many of the herbaceous plants, notably the red and white trilliums and adder's-tongues and the presence of several species such as the spring beauty and squirrel-corn, which do not occur elsewhere

on the Point.

This stretch of woods is the richest collecting ground for snails in the neighbourhood, particularly the maple-beech area just mentioned, which is the only spot where *Omphalina inornata* (Say) was found and where *Polygyra tridentata* (Say) and *P. palliata* (Say) are common. *Omphalina fuliginosa* (Griffith), *Vitrea multidentata* Binney and *Philomycus carolinensis* (Bosc.) were also frequently met with here but not often seen elsewhere.

The low land on the northwest side of the ridge extends to the lake on the north shore and its increasingly swampy soil is indicated in the gradual change in its tree growth from a mixture of poplar, birch, cedar, balsam fir, white pine and white spruce, etc., to a nearly pure stand of tamarack. In the opposite direction it passes into a somewhat open stand of poplar and birch with scattered conifers and other trees. This portion is a good place for many species of snails, certain forms such as *Polygyra thyroides* (Say) and *P. albolabris* (Say) being particularly common. Elsewhere this wood is very dense and not very productive of Mollusca, particularly in the tamarack swamp.

Half a mile west of the apex of the "Point" is a wide open marsh traversed by a sluggish creek, from which an interesting zonal distribution of vegetation can be traced back to the sandy ridge already mentioned. The creek rises in a small wooded ravine less than half a mile to the southwest and, until it reaches the open marsh, is a mere brook, following a devious course through woods, pastures and alder thickets.

The soil of De Grassi Point and the surrounding country is everywhere deep, there being no outcroppings of the bed-rock (Trenton limestone) but the higher parts are all plentifully bestrewn with boulders, chiefly of Laurentian gneiss.

It will be seen from the foregoing account that in spite of the general flatness of the district a considerable variety of conditions obtains in a very limited area (less than one square mile) and from a long acquaintance with the surrounding country I believe that nearly all the species of land Mollusca to be expected there will be found to occur at De Grassi Point or its immediate vicinity.

In the determination of the species of the following list I take pleasure in acknowledging my indebtedness to Mr. Bryant Walker of Detroit, Mich., who kindly examined the forms of whose identity I was in doubt. These included the species of *Vertigo, Euconulus, Strobilops* and *Gastrodonta* and several of *Vitrea* and *Bifidaria*. My determination of *Arion circumscriptus* Johnston was kindly verified by Dr. H. A. Pilsbry.

Since this paper was prepared for the press some additional collecting was done at De Grassi Point between April 27th and May

15th, 1917, and the data thus obtained have been included in the paper.

HELICIDAE.

1. *Polygyra tridentata* (Say). De Grassi Point, common but by no means abundant, occurring mainly in the hardwood bush, where maple and beech predominate. It was rarely seen elsewhere. Mature specimens were found from April 29th to September 20th. More abundant and generally distributed at Toronto. A single specimen was taken near St. William's, September 3rd, which was larger than those from the more northern localities.

2. *Polygyra fraudulenta* (Pilsbry). I found a large number of shells of this species on a steep wooded hillside at St. William's, September 3rd, where they were associated with *Gastrodonta intertexta, Polygyra thyroides* and *Pyramidula alternata.* They were distinctly smaller than the single specimen of *P. tridentata* from the same general locality, being of about the same size as the specimens of the latter species from Toronto and Lake Simcoe.

I have also seen a dead specimen of *P. fraudulenta* from the Don Valley, Toronto, taken on July 2nd, 1916.

3. *Polygyra palliata* (Say). De Grassi Point, rather scarce and almost confined to the beech-maple woods, though immature specimens were sometimes seen in the mixed woods. Adults were found only on June 23rd, July 25th. and September 20th. It is commoner at Toronto, Miss Ford having taken a number of specimens at several different stations in the vicinity of the city, and I also found it common in a rich hardwood bush near St. William's, September 3rd. It was not observed on the Giant's Tomb Island, although the locality appeared to be particularly favourable. It is probably near or beyond the northern limit of its distribution here.

4. *Polygyra albolabris* (Say). De Grassi Point, common and generally distributed, occurring in greatest numbers in the hardwood and poplar woods, but frequent also in the mixed diciduous and coniferous growth. Adults were apparently most numerous in June and early July and again in September. Occasional specimens of small size were found in somewhat dry or partly open grassy stations. They resembled the var. *maritima* in size but showed no other peculiarities.

This species is equally common at Toronto and was taken also at Go Home Bay, Giant's Tomb Island and near St. William's.

5. *Polygyra thyroides* (Say). De Grassi Point, about as common as *albolabris,* frequenting similar stations but apparently more partial to poplar woods, or mixed growths of poplar, birch, elm, cedar, balsam fir, etc., than the typical hardwood bush. Adults appeared throughout the season but seemed to be scarcer during August than at

other times. It has also been taken at Toronto and was abundant at St. William's.

6. *Polygyra sayana* Pilsbry. This species occurs sparingly at De Grassi Point, only five mature examples having been found. The dates of these are July 3rd, 25th, August 15th, 19th, September 20th. These were taken in both hardwood forest and poplar woods. I also took another specimen at Canoe Lake, Algonquin Park, July 26th, 1916.

7. *Polygyra fraterna* (Say). Adult and young individuals of this species were very common at De Grassi Point, throughout the season from April 27th to September 20th, particularly in the latter month and in early spring. It was very generally distributed in the woods. I found it also in a low wooded ravine at Go Home Bay, July 16th, and on Giant's Tomb Island, July 30th. It is also common at Toronto and St. William's.

CIRCINARIIDAE.

8. *Circinaria concava* (Say). De Grassi Point, common and generally distributed in moist woods, mature specimens occurring throughout the season. It is likewise common at Toronto, Miss Ford having collected a number of specimens in the vicinity of the city (Mimico, York Mills, Lambton and the "old Belt Line Cut"), from July 22nd to September 4th; I have also found it here in May. It grows to a larger size at Toronto than at De Grassi Point. I have observed this species feeding upon *Zonitoides arborea.*

ZONITIDAE.

9. *Omphalina fuliginosa* (Griffith). De Grassi Point, fairly common in the hardwood forests, adults having been taken from June 29th to September. When inactive they were usually found under dead leaves. I have also taken it in the vicinity of Toronto.

10. *Omphalina inornata* (Say). De Grassi Point, August 19th and 20th, four mature specimens from the maple-beech woods. These are the only specimens of this species that I have seen. It is one of the rarest species in this locality.

11. *Vitrina limpida* (Gould). During the latter part of June I first noticed the delicate shells of this species under boards and rubbish along the edge of a belt of trees skirting the lake shore at De Grassi Point. The ground here is low and the trees consist largely of tall elms, basswood, white cedar and balsam fir with nannyberry (*Viburnum lentago*) and hawthorns in the more open places and along the edge next to the pasture. Some young individuals were found with the shells but they were more abundant in the grass along the edge of the pasture, where it was necessary to lie down and examine the ground closely in order to detect them. These immature specimens grew gradually larger during the summer and full grown specimens were seen in September.

A single specimen of this snail was found by Miss Ford at Point au Baril, Georgian Bay, on August 11th, 1916.

12. *Vitrea cellaria* (Muller). This European species was found by Miss Ford in considerable numbers in the greenhouse of the Botanical Department of the University of Toronto. It was first noticed on February 16th, 1917. It had already been taken in Toronto many years ago by the late Dr. Wm. Brodie.

13. *Vitrea hammonis* (Ström). De Grassi Point, July 4th-24th, under logs, chips and bark in woods. It does not appear to be very common. It was also taken by Miss Ford in the vicinity of Toronto (Lambton and York Mills) in September.

14. *Vitrea binneyana* (Morse). Not uncommon at De Grassi Point, occurring with the preceding species in the hardwood and mixed forest. My specimens are dated from July 22nd to August 25th, but they probably occur throughout the season. It was also found on Giant's Tomb Island, July 20th, and Miss Ford took a single specimen at Point au Baril on August 16th, 1916.

15. *Vitrea rhoadsi* Pilsbry. Miss Ford took a fine specimen of this rare species in the "Belt Line Cut" Toronto, on August 28th, 1916.

16. *Vitrea indentata* (Say). A very few specimens were found in a wooded ravine at Go Home Bay, July 16th. It was not noticed elsewhere.

17. *Vitrea ferrea* (Morse). This pretty little ribbed form was occasionally found under bark and rubbish in the woods at De Grassi Point during July and August.

18. *Vitrea multidentata* Binney. This interesting little snail, so different in appearance from the other Vitreas, was found throughout the summer at De Grassi Point, occurring most plentifully in the hardwood, but nowhere abundant.

19. *Euconulus fulvus* (Muller). A specimen of this species was taken at Go Home Bay, July 16th, and it also occurred sparingly at De Grassi Point, but it was not distinguished in the field from the next species. The earliest adult was taken on April 29th, 1917.

20. *Euconulus chersinus polygyratus* (Pilsbry). A common little snail at De Grassi Point, where it is generally distributed in the woods, especially in more or less damp places. Adults were most plentiful during late June and July. Miss Ford found a single adult at Lambton (near West Toronto), September 4th, 1916, and an immature example at Victoria Park, Toronto, October 7th. I found it again in early May, 1917.

21. *Zonitoides nitida* (Muller). This dark-coloured snail occurs in abundance in open marshes at Toronto and De Grassi Point, where it is most easily found by turning over logs and boards. It was found throughout the summer and autumn.

(*To be continued*)

THE LAMPREYS OF EASTERN CANADA.

BY A. G. HUNTSMAN, B.A., M.B.,

Biological Department, University of Toronto,
Curator, Atlantic Biological Station.

The lampreys are of exceptional interest, owing to their peculiar structure and life history, as well as from the fact that they are the most primitive of vertebrates. Comparatively little is known concerning their distribution in our waters. It is therefore of interest to have the accessible records brought together.

I must express my indebtedness to Mr. C. W. Nash, Provincial Biologist, for the privilege of examining specimens from his collections in the Provincial Museum, to Prof. B. A. Bensley for access to the collection of the Biological Department, to Prof. A. Willey for enabling me to examine material in the Peter Redpath Museum, McGill University, to Mr. G. J. Desbarats, C.M.G., Deputy Minister, and Mr. A. Halkett, Curator, for material from the Fisheries Museum, Ottawa, Ont., and to Mr. F. Johansen for kindly examining specimens in the collection of the Victoria Memorial Museum, Ottawa.

Entosphenus wilderi (Jordan and Evermann). Brook Lamprey.
Syn. *Ammocoetes branchialis* (Auct. Amer.)
Lampetra wilderi.

Seven Islands, Quebec. (Huard, 1902, p. 169).

Northern and western streams of Ontario (?). Nash, 1908, p. 10).

Don River, York County, Ontario. (coll. Biological Department, University of Toronto and coll. Ontario Provincial Museum).

I have found it to be very abundant in the Don river near Toronto. Adults, both males and femals, were taken during April in 1913, and on May 7 many were obtained. This is the breeding season, which, according to Gage (1893, p. 444), lasts usually from May 8 to May 20 in the tributaries of Cayuga lake. On October 20, 1913, an adult, 19 cm. long was obtained, and also a larva, 12½ cm. long, which is probably to be referred to this species. I have been able to examine a very complete series from Mr. Nash's collection, also from the Don river, consisting of immature adults, and mature males and females.

Regan (1911, p. 202) places this species in the genus *Entosphenus*, which he distinguishes from *Lampetra* by the presence of a semicircle of small teeth on the lower or posterior side of the buccal disk. This semicircle connects the last bicuspid teeth of either side. This character seems to be more constant than those used by Jordan and Ever-

mann (1896, p. 9) for separating the two genra. For example, *Lampetra* is said to have the extraoral teeth never tricuspid and yet *L. ciberia* is described as having the middle tooth of each side usually tricuspid. With their diagnosis of the genus this species is included.

Ichthyomyzon bdellium (Jordan). Silvery Lamprey.

Syn. *I. concolor.*

St. Lawrence river below Quebec (Fortin, 1864 as *Petromyzon*).

St. Lawrence river (Provancher, 1876, p. 262, as *I. castaneus*).

St. Lawrence river near Montreal (Huard, 1902, p. 169).

Go Home river, Georgian bay (Bensley, 1915, p. 9).

Brigham's Creek, Hull, Que., May 6, 1908, (coll. Canadian Fisheries Museum, Ottawa).

"North River, Ottawa" (coll. Peter Redpath Museum, McGill University).

Point Pelee, Lake Erie, 1913 (coll. Victoria Memorial Museum, Ottawa, No. 1012).

Lake St. Clair, 1882, from a pike (coll. Biological Department, University of Toronto).

Mitchell bay, Lake St. Clair, April 30, 1880 and 1883 (coll. Biological Department, University of Toronto).

I have been unable to obtain any examples from the drainage area of Lake Ontario. Its occurrence both in the St. Lawrence river and its tributaries and in the upper lakes makes it fairly certain that it will be found in the waters of Lake Ontario also. Much collecting has been done, however, in the waters of northern New York State, yet I know of no record of its occurrence there except at Cape Vincent on the St. Lawrence (Evermann and Kendall, 1902b, p. 235). To the northwest it has been reported from the Hayes (or Hill) river in Manitoba (Evermann and Goldsborough, 1908, p. 90), which is not far from the boundary of Ontario. It is probably generally distributed throughout northern Ontario.

Jordan and Evermann (1896, p. 10) state that the anterior lingual lamina in *Ichthyomyzon* is divided by a median groove, whereas Regan (1911, p. 199) gives it as "a single transverse denticulated ridge." In a series of specimens, ranging from 9.2 to 37 cm. in length, in no case is there an actual division of the lamina into two parts, but in all cases there is a median groove (deeper in the larger specimens), which is similar to that seen in *Petromyzon marinus*. In the latter, however, the teeth on the lamina appear to be distinctly longer. The lingual lamina would seem to be of no value in separating these genera.

Characters, in the specimens at hand, that distinguish this species are:

Dorsal fin continuous, with a broad, shallow notch.

Supraoral lamina with from two to four cusps (two in all cases except one, where there are four).

Infraoral lamina with from five to nine cusps (5, 6, 6, 7, 7, 7, 8, 8, 8, 8, 9, 9).

Lateral teeth all unicuspid (one specimen, 17:5 cm. long of doubtful origin has one bicuspid tooth on the left side and three on the right).

18 to 21 complete radial rows of teeth, counted on side next mouth (18, 18, 18, 19, 20, 20, 20, 20, 20, 20, 21, 21).

The new species, *I. fossor*, described by Reighard and Cummins (1916) from Michigan, differs in a large number of points from this species. The most striking thing is the degeneration of the dentition, the radial rows being incomplete peripherally. There is at the same time an increase in the number of cusps on the infraoral lamina (8 to 10) and in the number of the radial rows (28 in the specimen figured). The latter character is to be found also in *Entosphenus wilderi*, which has a still further reduction in the dentition.

Forbes and Richardson (1908, p. 9) consider that the western form (*I. castaneus*) is not distinct from this. Illinois appears to be in the transition region between the two forms, which are evidently only geographical varieties. Somewhat over half of their specimens had bicuspid extraoral teeth.

Regan (1911,, p. 199) has rightly restored Jordan's name (*bdellium*) for this species. Kirtland's name (*concolor*), under which this species has ordinarily gone, was based on a larva which may or may not have belonged to this species.

Petromyzon marinus L. Sea Lamprey.

This form is found on the coasts of the lower provinces and enters their rivers.

"Saint-Joseph de Levis," Quebec (Roy, 1906, p. 33).

Petromyzon marinus, var. *dorsatus* Wilder. Land-locked Sea Lamprey.

Syn. *Petromyzon marinus unicolor*.

Great Lakes (Wright, 1892, p. 439 as *P. concolor*).

Great Lakes (Nash, 1908, p. 9 as *Ichthyomyzon concolor*).

Lake Ontario (Nash, 1913, p. 249 as *I. concolor*).

Lake Ontario (Bensley, 1915, p. 10).

Port Credit, Lake Ontario (coll. A. R. Cooper).

Lake Ontario (coll. Provincial Museum).

This form has for Canada been reported definitely only for Lake Ontario. Bensley suggests that a large lamprey reported by fishermen from the upper lakes may prove to be this species. Wright's figure of the oral hood is definitely referable to this species, which was confused with *Ichthyomyzon bdellium*. The latter had been found in Lake Erie, therefore the distribution was given as the "Great Lakes." Nash's reference was similarly due to a misconception.

The chief points in which this species (both typical and land-locked varieties) differs from the preceding are the following.

Dorsal fins separated (except at the breeding season in the males, but the notch is always deep).

Four bicuspid teeth on each side of mouth.

Fifteen to eighteen radial rows of teeth on disk, counted next the mouth opening.

Jordan and Fordice (1886, p. 284) refer Dekay's (1842, p. 383) *Ammocoetes unicolor* to this variety. This is doubtful, since Dekay's description and name was based upon a larva from Lake Champlain. That it was the larva of this variety cannot be considered proved. Evermann and Kendall (1902a, p. 218) identify the *Ammocoetes unicolor* of Dekay with *Ichthyomyzon concolor* (=*bdellium*). Wilder's name *dorsatus* (in Jordan and Gilbert, 1883, p. 869) is therefore to be used for the land-locked variety of *P. marinus,* although based upon a character which is not distinctive of that variety.

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SOME NOTES ON ETHNO-BOTANY.

BY F. W. WAUGH.

The number of things botanical employed by our Canadian Indian tribes, in spite of their non-agricultural tendencies, is not inconsiderable. These have to do with food, textiles, clothing, medicine, warfare, the hunt, ceremonial procedure, and, in fact, with almost every phase of their activities.

One of the most interesting of these uses of native raw materials is in connection with textiles and vegetable fibres for weaving, sewing or tying. It is not likely that any discoveries of great economic value will be made, but it would be interesting to note to what extent some aboriginal materials could be utilized in modern arts and handicrafts.

Several of our eastern woodland tribes, including the Ojibwa and the Iroquois, make, or formerly made, excellent bags for various purposes of basswood inner bark or bast. The Ojibwa of northern Ontario still manufacture these in a number of very pleasing colours and designs. The material is soft, flexible, possesses good wearing qualities and is easily prepared.

The first step in the process of bag-making is to pull off the bark from young trees in long strips, and then to detach the bast from the more brittle outer bark. The bast is then folded into small bundles and boiled for a while with wood ashes, or until it can be easily rubbed or shredded into a fine, soft material. A portion of this is twisted into a rather firm cord and used as the warp in an open twined weave, the woof consisting of larger rolls or wisps of the untwisted fibres, some of which are dyed and in this way worked into various patterns.

Other very good fibres, which are prepared and used in much the same way, are obtained from the outer portion of the stems of the swamp milkweed (*Asclepias incarnata*), also from various species of dogbane (*Apocynum*), and from the hemp nettle. These are taken in the fall or late summer when the stems are mature. Slippery elm bast is also employed.

An aboriginal tying material found quite plentifully around Ottawa is the bast of the leatherwood or moosewood (*Dirca palustris*). Farmers, in fact, sometimes use this for tying grain bags. It was formerly sometimes used by the Iroquois for the bow-string in the bow-drill method of firemaking by friction.

Swamp milkweed fibre is frequently used by the same tribe for pulling teeth. Its use is said to prevent the decay of those remaining.

Strings for bows in hunting and warfare were often made of the bark of young hickories twisted.

The Ojibwa around Lake Nipigon use the bark of one of the willows (*Salix humilis*) for attaching the anchor-stones and floats to nets.

A number of tribes use the long slender roots of the spruce, which are found just under the surface, for sewing canoes and in the making of birchbark utensils of various kinds. The roots are split so that each strip retains part of the smooth, rounded, outer surface: the heart, or inner portion being discarded. The strips are soaked or kept moist in sewing, holes being punched in the birchbark with an awl for the insertion of the sharpened end of the strand of root. The combination of the birchbark and the spruce root sewing or binding

material gives a very pleasing and decorative effect. The birchbark is kept moist, or used while fresh and is cut so as to form flat trays, oblong and round box-like articles; while some are made like buckets. A withe of some shrub, such as the alder or willow, is bound around the top to strengthen the edge. The birchbark is most easily detached in the spring. The bark of the common elm (*Ulmus americana*) is used by the Iroquois for basket or tray making. This is a very fine and beautiful material and is also taken off the tree in the spring. The rough corrugations on the outside are planed or pared down somewhat to render the surface more even, this surface forming the outside of the receptacle. The bark is kept pliable by soaking, and is usually sewn with basswood bast, although spruce root could no doubt be used.

A very beautiful coiled basketry is made by the Salish and other western tribes from spruce root. The strands used for the sewing or binding are made as just described, while the coils around which these finer strips are sewn are made from the rougher shreds of the root. The method in general may be said to resemble that employed in raffia work, but the product is much more substantial and beautiful. A very good collection of spruce root basketry from the interior Salish and other tribes may be seen at the Victoria Memorial Museum.

THE AMERICAN GOLDEN PLOVER IN EASTERN ONTARIO.

By E. Beaupre, Kingston, Ont.

After an absence of almost fifteen years, the Golden Plover has apparently resumed its migratory visits to eastern Ontario. During the long period of their absence one was forced to return from a visit to their former haunts with a feeling that an important and delightful feature of the out-door world was missing; the old pasture fields and gravel-covered shores formerly enlivened by the cheerful and friendly whistle of large flocks of plover were deserted, and the existence of these intensely interesting birds threatened to become a memory. The only opportunity to observe them locally was afforded during their migration southward in the months of August and September.

For some years previous to 1901, their numbers were gradually diminishing, but from September 1901 to August 1915, so far as the writer could possibly learn, this plover was not recorded as a fall migrant in eastern Ontario. During that long period, the only evidence of the bird's existence was afforded by the night flights of flocks over the writer's home, and recorded at different times. In a valuable bulletin written by the late Prof. W. W. Cooke of the Biological

Survey, Washington, D.C., the migratory routes of the Golden Plover have been carefully reviewed. So far as a spring visit from this bird is concerned in eastern Ontario, it might be safely ventured that a record is unknown.

The plover breeds well within the Arctic Circle, and at the close of the short northern summer, the birds gather in great numbers in preparation for their southern migration. The flocks flying south pass on their route to the east of Hudson's Bay, and make their first stop, we are informed, in Labrador where they enjoy feasting on native berries which grow in abundance along the bleak and wind-swept coast. Continuing their southward journey they make their way to the coast of Nova Scotia, from which locality they make their long flight of twenty-four hundred miles to South America, always waiting for favorable weather conditions before undertaking the flight. The time of arrival, dates of departure, and the route travelled can be accurately recorded, and yet the real concrete cause for the long journeys of these members of the feathered family, have remained, and probably always will remain, one of the unsolved problems of the bird world.

From notes on this subject of the migration of the Golden Plover, it is evident that this bird's route is by no means confined to the eastern or Atlantic coast, but that it has other means of reaching its temporary southern home during the rigorous months of the northern winter, the writer, as well as others, is satisfied. During the month of September vast numbers of plover follow the west coast of Hudson's Bay, and pass over the eastern end of Lake Ontario on their way south.

In September, 1906, a great flight of plover passed over the city of Kingston, which is located on the extreme eastern end of Lake Ontario. The flight was first noticed about eight o'clock in the evening, and to one familiar with the soft, sweet piping of the Golden Plover, there was no difficulty whatever in recognizing the bird. A record of flight showed that eight flocks passed over the city, flying very low, at intervals of about ten minutes. Towards midnight it was impossible to enumerate the flocks, the flight being continuous. This must have been the main migration for that year, and it continued until four o'clock in the morning, covering eight hours. Allowing a speed of twenty-five miles an hour—a conservative estimate—the distance between the leading flocks and the rear guard, must have been approximately two hundred miles. What a sublime spectacle this would have been had one the privilege of seeing it in the open light of day! The vanguard of this great aerial aggregation must have reached almost to the Atlantic seaboard, while the rear flocks were trailing their wonderful way over the eastern waters of Lake Ontario. They no doubt began their ocean journey some miles south

of the coast of Nova Scotia, but not far enough to seriously affect their regular route to Argentina, in which country they escape the hardship of a Canadian winter.

It is well known that some species of migrating birds when passing over large bodies of water in daytime, fly quite low, often skimming the very surface, but when flying over large tracts of land, they fly at a great height. In this connection it may not be amiss to detail some personal field experience on this interesting phase of bird life and conduct. About May 20th in each year small flocks of Ruddy Turnstones begin to arrive in this northern country from the sunny south. By the end of the first week in June the shores of many of the Islands adjacent to the city of Kingston present scenes of life and activity well worth travelling many miles to witness. On two distinct occasions the writer had the unusual good fortune to be privileged to witness the departure of this gathering of birds for a place situated farther north where their breeding grounds were located. Towards evening a sudden commotion occurred among the birds, and with a movment born of common impulse, all formed into one large flock, and after taking a short flight which looked like a farewell survey of their location, they moved upwards in a great circle. With the aid of glasses it was possible to follow their flight, and see them setting their course due north, pursuing it high above the land surface far beyond the scope of the naked eye.

Another striking example of this nature occurred late in the month of October, 1916. A bleak north wind was blowing with frequent showers of rain. Towards noon a flock of Tree Swallows suddenly came twittering down out of the sky from a great height descending from the rain-laden clouds. The straggling flock looked like dead leaves blown about by an autumn gale. The flock settled on some trees on the lake shore, and by crowding and huddling together they completely covered the branches. Some settled in the grass under the trees. So exhaustd was the entire flock that a near approach was permitted without alarm or apparent concern. In the afternoon, they quietly left their resting place, and flying low over a pasture field, began to gyrate in a great circle, their spiral ascent carrying them higher and higher until they faded beyond the range of human vision.

Returning to the subject of the Golden Plover, on August 28th, 1915, a few were noted and in 1916 on the same date, a more extensive visitation occurred. Rev. C. J. Young observed some of these birds on the sand beach at Brighton, Ont. The writer saw eighty or more at Amherst Island, Ont., and several small flocks were seen at Wolfe Island, Ont. August and September this year will be watched with great interest for more interesting developments in connection with the Golden Plover's visits and sojourn in eastern Ontario.

THE OCCURRENCE OF THE BOHEMIAN WAXWING (BOMBYCILLA GARRULA) AT ARNPRIOR.

On the afternoon of April 28th last while out on one of my usual, almost daily, bird walks, I had the good fortune to observe a single male specimen of this beautiful northern species. I was walking through a rather thick growth of prickly ash and hawthorne, when a waxwing suddenly flew up into a neighboring pine. Its large size and the considerable amount of white on its wings at once convinced me that it was not the Cedar Waxwing. As I approached the pine tree, the bird flew back into the shrubbery, where I was able to observe it closely with my glasses for nearly ten minutes. Its large size, black chin and the yellow and white markings on the wings were plainly visible, so I have not the slightest doubt of the correctness of my identification, even though the bird was not collected. This is the first record I have of the Bohemian Waxwing at Arnprior.

A. L. GORMLEY.

BOOK NOTICE.

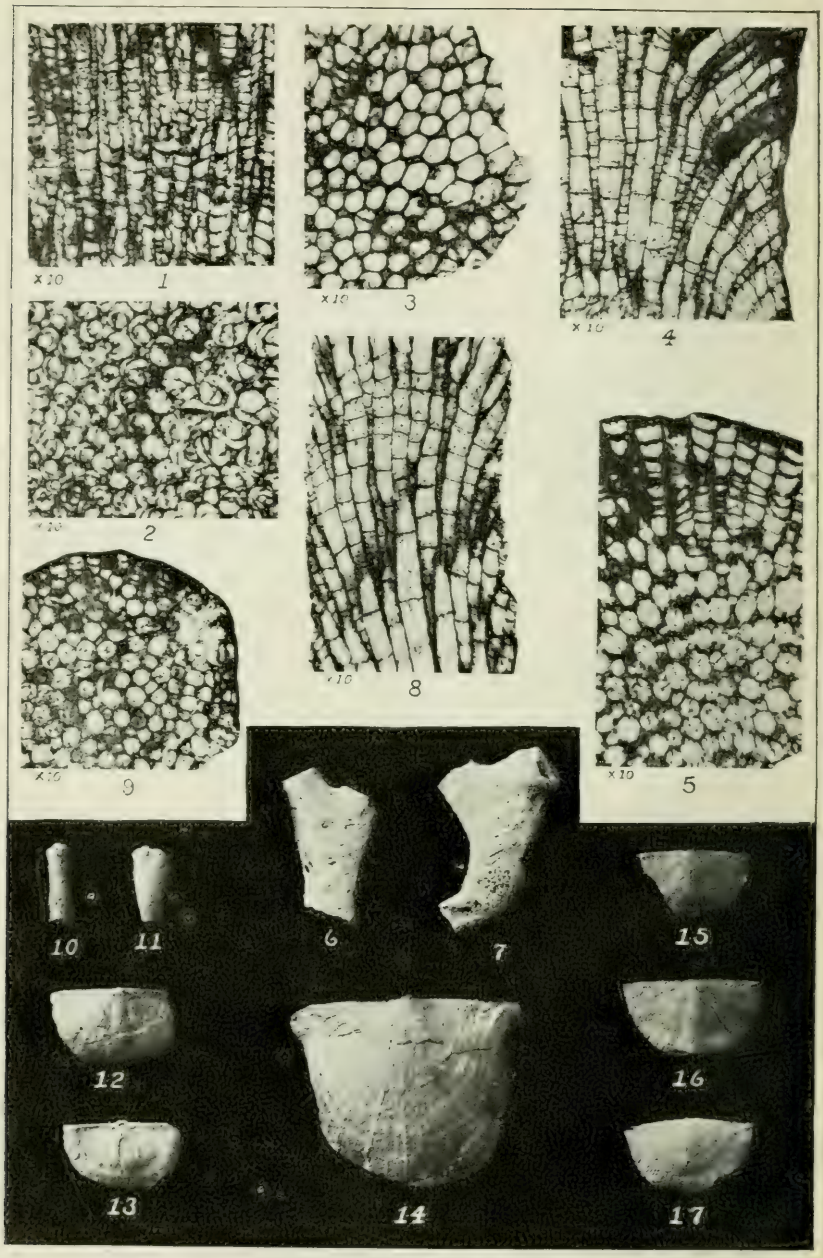
ANIMAL MICROLOGY, by Michael F. Guyer, Ph.D., Profesosr of Zoology in the University of Wisconsin, with a chapter on drawing by Elizabeth A. Smith, Ph.D., Instructor in Zoology in the University of Wisconsin. Revised edition, February, 1917. The University of Chicago Press, Chicago, Ill.; price $2.00.

The reception accorded the first edition of *Animal Micrology*, printed in 1906, induced the author to revise the volume and include some of the many new methods employed in zoological micro-technique. Certain portions of the volume have been entirely rewritten and two new chapters, one on "Cytological Methods" the other on "Drawing" have been added. The latter chapter was prepared by Dr. Elizabeth A. Smith.

The volume is a most useful one, comprising 289 pages and therefore considerably larger than the first edition. It will undoubtedly have a wide distribution. As in the first edition the policy has been, the author states, not to attempt to give all "best" methods, but rather to select representative good ones which have proved their work by satisfactory tests in American laboratories. 74 illustrations are included in the text.

NOTE.

About 9 a.m., April 3, a flock of forty-two wild geese passed over the Victoria Museum, Ottawa, flying in a northwesterly direction. At the same time a flock of six ducks passed northward crossing directly above the geese.—C. L. PATCH.



ILLUSTRATING "The Trenton Fauna of Wolfe Island, Ontario," by Kirtley F. Mather.

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THE TRENTON FAUNA OF WOLFE ISLAND, ONTARIO.

By Kirtley F. Mather, Queen's University, Kingston, Ont.

West of the Frontenac axis in Ontario, the most easterly outcrops of Trenton limestone are those on Wolfe Island at the foot of Lake Ontario between Kingston, Canada, and Cape Vincent, New York. The strata exposed there are the northward continuations of the Ordovician rocks of northern New York and present quite a different succession from that in the Ottawa Valley. It is evident that the Frontenac axis even in mid-Ordovician time was sufficiently defined to influence the boundaries of land and sea.

The Trenton limestones on Wolfe Island rest upon somewhat similar formations of Black River age. All dip at a very low angle toward the southwest. The contact between Trenton and Black River strata is not exposed but is probably similar to that in the Cape Vincent-Watertown district, a few miles to the southeast in New York State. A distinct unconformity is there indicated* by the presence of a basal conglomerate and an irregular contact. Disconformity is strongly suggested on Wolfe Island by the marked change in fauna between the Black River limestones along the north shore and the Trenton strata which outcrop in the interior and along the southern shore.†

Prasopora simulatrix orientalis, Pachydictya acuta, Dalmanella rogata, and *Rafinesquina alternata* are the ubiquitous and characteristic members of the local fauna. They indicate its alliance to that of the "Prasopora zone" or true Trenton as that term is used by Raymond.‡ The fauna at hand has little in common with that of the Hull formation in Ottawa Valley or of the Glens Falls limestone in Mohawk

*H. P. Cushing, Geology of the Thousand Island Region: N. Y. State Mus. Bull. 145, p. 91, 1910.

†See geologic map by M. B. Baker, The Geology of the Kingston district; Ontario Bureau Mines, vol. 25, pt. 3, 1917. The Wolfe Island Trenton is described by E. M. Kindle in Appendix I. of the same report.

‡P. E. Raymond, The correlation of the Ordovician strata of the Baltic basin with those of eastern North America: Bull. Mus. Comp. Zool., vol 56, p. 255, 1916.

Valley. *Triplecia extans* and *Receptaculites occidentalis* are listed by Raymond as characteristic of the Rockland formation which underlies the Hull near Ottawa. Both are present in the Wolfe Island Trenton but are represented in the collections at hand by only two and one specimens respectively.

The collections and studies upon which this paper is based were made in part during the preparation of a report* on the geology of the Kingston district. After that report had gone to press, additional collections were made from the old as well as from new localities. The complete faunal list follows.

TRENTON FAUNA OF WOLFE ISLAND.

	Locality			Numbers		
	222	223	224	226	308	309
PORIFERA.						
Receptaculites occidentalis Salter	---	x	---	---	---	---
ANTHOZOA.						
Streptelasma corniculum Hall	---	---	---	x	---	---
BRYOZOA.						
Prasopora simulatrix orientalis Ulrich	x	---	x	x	x	x
Eridotrypa aedilis (Eichwald)	---	---	x	x	---	---
Eridotrypa aedilis minor (Ulrich)	---	---	x	x	---	---
Eridotrypa exigua Ulrich	x	---	---	---	---	---
Hallopora ampla (Ulrich)	---	x	---	---	---	---
Hallopora obliqua n.sp.	---	x	---	---	---	---
Hallopora varia n.sp.	---	---	---	x	---	x
Batostoma winchelli Ulrich	---	---	x	x	---	---
Stictoporella angularis Ulrich	---	---	x	---	x	x
Pachydictya acuta (Hall)	x	---	x	x	x	x
BRACHIOPODA.						
Trematis sp.	x	---	---	---	---	---
Schizocrania filosa (Hall)	---	---	---	x	---	---
Orthis tricenaria Conrad	---	x	---	x	---	---
Dalmanella rogata (Sardeson)	x	x	x	x	x	x
Dinorthis pectinella (Emmons)	---	x	---	x	---	---
Plectambonites curdsvillensis Foerste	---	---	?	x	x	---
Plectambonites punctostriatus n.sp.	x	---	---	---	x	---
Rafinesquina alternata (Emmons)	---	x	x	x	---	x
Rafinesquina deltoidea (Conrad)	x	---	---	x	---	---

*M. B. Baker, The geology of the Kingston district, with appendices by E. M. Kindle, Alice E. Wilson, and Kirtley F. Mather; Ontario Bureau Mines, Vol. 25, part 3, 1917.

	Locality			Numbers		
	222	223	224	226	308	309
Triplecia extans (Hall)	x	x	---	---	---	---
Parastrophia hemiplicata (Hall)	---	x	---	x	---	---
GASTROPODA.						
Sinuites cancellatus (Hall)	x	x	---	---	---	---
Liospira vitruvia (Billings)	---	x	---	x	---	---
Hormotoma gracilis (Hall)	x	---	---	x	---	x
Hormotoma trentonensis Ulrich and Scofield	---	---	---	x	---	---
CONULARIDA.						
Conularia trentonensis multicosta Ruedemann	---	---	---	x	---	---
CEPHALOPODA						
Orthoceras junceum Hall	x	---	---	x	---	x
Endoceras proteiforme Hall	---	---	---	x	---	---
TRILOBITA.						
Isotelus gigas De Kay	x	---	---	x	---	---
Bumastus sp.	---	x	---	---	---	---
Calymene senaria Conrad	x	---	---	x	---	x
Ceraurus dentatus Raymond and Barton	x	---	---	---	---	---
Ceraurus pleurexanthemus Green	x	x	---	---	---	---
OSTRACODA.						
Leperditia sp.	---	x	---	---	---	---

Locality List.

Station 222—Lower five feet of Trenton limestone, four miles southwest from Marysville, Wolfe Island. Lot 2, north, Con. III.

Station 223—Trenton limestone, probably ten or twelve feet above the base of the formation, one and one-half miles southeast from Marysville, Wolfe Island. Lot 1, north, Con. VIII.

Station 224—Lower seven feet of Trenton limestone, immediately south of Cold Springs corner, Wolfe Island. Lot 3, Con. IX.

Station 226—Trenton limestone, probably twenty or thirty feet above its base, along southern shore of Bear Point at southwestern extremity of Wolfe Island.

Station 308—Trenton limestone, probably fifteen or twenty feet above its base, in small ravine one and one-quarter miles south-east from Cold Springs corner, Wolfe Island. Lot 1, north, Con. IX.

Station 309—Trenton limestone, about fifteen feet above its base, along course of small brook tributary to Bayfield Bay. Lot 1, south, Con. X., Wolfe Island.

DESCRIPTION OF SPECIES.

Phyllum MOLLUSCOIDEA.
Class BRYOZOA.
Order TREPOSTOMATA.
Family HALLOPORIDAE.
Genus HALLOPORA Bassler.

HALLOPORA VARIA n. sp.

Plate I, figs. 3-7.

Zoarium composed of subcylindrical branches, 5 to 8 mm. in diameter, bifurcating at frequent intervals; one fragment 22 mm. long has given off five branches. Surface of branches gently undulatory but without conspicuous monticules or maculae. Zooecial apertures angular, about 10 in 3 mm.; walls ridge-like and thin; mesopores very few, generally occurring only in limited areas of the surface.

Tangential sections show the zooecia to be everywhere in contact with each other except in certain spots where small mesopores occupy the angles between zooecia. Vertical sections in the axial region display two sets of tubes, the smaller of which represents mesopores, and the proximal portion of zooecia; in the larger tubes the diaphragms are from 0.2 to 0.5 mm. apart, with an average distance of about 0.35 mm.; this is slightly greater than the diameter of the tubes, which almost invariably falls between 0.28 and 0.33 mm. The smaller tubes contain diaphragms which are only 0.11 to 0.17 mm. distant, generally about as far apart as the diameter of the tube. In the peripheral zone the tubes bend rather abruptly and proceed toward the surface with only slight obliquity; here the diaphragms are from one-third to one-half the diameter apart.

This form is most nearly related to *H. angularis* (Ulrich). The chief differences are the larger size of the branches, the greater distance between diaphragms in the axial portion of zooecial tubes, and the less pronounced crowding of diaphragms near the apertures.

Horizon and locality: Lower Trenton Limestone; Wolfe Island, Ontario, (Stations 226 and 309).

HALLOPORA OBLIQUA n. sp.

Plate 1, figs. 8-11.

Zoarium ramose, composed of slender cylindrical branches, 2 to 4 mm. in diameter, bifurcating at comparatively remote intervals; surface of branches slightly undulatory but without conspicuous monticules or maculae. Zooecial apertures polygonal, with thin smooth ridge-like walls, about eleven in 3 mm. Mesopores open at the surface, polygonal in cross-section, about as numerous as the zooecial apertures.

Transverse sections show that the axial region is composed of two sets of tubes; the larger average 0.25 mm. in diameter and are hexagonal to octagonal in outline; the smaller are generally between 0.1 and 0.15 mm. in diameter and display triangular or quadrangular outlines. Peripheral region comparatively thin, less than 0.4 mm. in width in a section across a branch with a diameter of 3.9 mm.

Longitudinal sections display slightly flexuous zooecial tubes which intercept the surface quite obliquely and lack the decided curvature commonly found in other species of the genus. Mesopores are indistinguishable from the proximal portion of zooecial tubes and doubtless the two had similar functions. Diaphragms numerous and quite regularly spaced, crossing zooecial tubes in proximal and axial regions at distances equal to from one to two times the diameter of tube. Near the surface diaphragms are more numerous and generally two or three of them occur in a space equal to their diameter.

That the specimens at hand are mature individuals, even though the zooecial tubes aproach the surface obliquely with little curvature from axial to peripheral regions, is evident from the closer spacing of the outermost two or three diaphragms in each tube as well as from the thickening of the wall near the aperture.

In comparison with *H. angularis,* which it resembles in the angular appearance of apertures, this species is distinguished by its smaller zooecia, the generally more slender branches of the zoarium, and the obliquity of the zooecial tubes. *H. obliqua* is probably more nearly related to *H. ampla* and *H. goodhuensis* than to any other described member of the genus. Its branches are on the average slenderer than the smaller of those two species while its zooecia are intermediate in size between them. More significant, however, is the much fewer number of diaphragms in the peripheral zone of the material at hand.

Horizon and locality: Lower Trenton limestone; Wolfe Island, Ontario, (Station 224).

Class BRACHIOPODA.
Order NEOTREMATA.
Family TREMATIDAE.
Genus TREMATIS Sharpe.

TREMATIS sp.

The shell thus identified is imperfectly preserved but undoubtedly represents a new species of this genus. The specimen is very small, about 3 mm. long and 4 mm. wide, and consists of a pedicle valve, from which the apex is broken away, revealing a portion of the interior of the brachial valve. The apex appears to have been much nearer the posterior margin than the center of the valve. Surface markings are of the *T. umbonata* type and consist of radiating rows of circular pits

separated by flat interspaces which are generally broader than the diameter of the pits. Between 15 and 20 rows occur in the space of 1 mm. The general outline of the valves is transversely elliptical, somewhat similar to that of *T. punctostriata.*

Horizon and locality: Lower Trenton limestone; Wolfe Island, Ontario, Station 222.

Order PROTREMATA.

Family STROPHOMENIDAE.

Genus PLECTAMBONITES Pander.

PLECTAMBONITES PUNCTOSTRIATUS n. sp.

Plate I, figs. 15-17.

Shell of medium size, transversely semi-elliptical in outline, cardinal angles slightly acute but not auriculate; adult shells varying in width between 16 and 21 mm., in length between 9.5 and 12 mm. Surface of both valves marked by fine, thread-like, radiating lirae, 4 to 6 of which occur in the space of 1 mm.; every second or third lira slightly more prominent than the intermediate, newly developed ones; depressions between lirae occupied by rows of minute punctures which give the whole surface a finely rugose aspect. Dimensions of four typical specimens are: width, 14.1, 16.0, 18.3, and 20.8 mm.; length, 7.8, 9.6, 10.3, and 11.7 mm.

Pedicle valve more convex than in *P. curdsvillensis,* with the point of greatest convexity a little behind the mid-length of the shell; beak and cardinal area as in the general *P. sericeus* type; lateral margins rounding broadly into the convex anterior margin. A low, narrow, mesial fold originates near the beak and broadens anteriorly; in most individuals this is a fairly conspicuous feature of the shell, but in a few it is scarcely perceptible. Cardinal margin crenulated by a series of oblique wrinkles which in most specimens make their appearance within 2 mm. of the beak and become progressively longer toward the cardinal extremities; about 4 or 5 wrinkles occur in the space of 3 mm. and the angle between them and the hinge line is generally between 30° and 40°; in some individuals the crenulations are scarcely perceptible but they are rarely entirely lacking. Interior of valve not known.

Brachial valve not positively identified.

The shells subsumed here are most nearly related to *P. rugosus* (Meek), but the present species differs from that one most conspicuously in the presence of a mesial fold and sinus as well as in the greater equality of its radiating lirae.

Horizon and locality: Lower Trenton limestone; Wolfe Island, Ontario, Stations 222 and 308.

PLECTAMBONITES CURDSVILLENSIS Foerste.

Plate I, figs. 12, 13.

Plectambonites curdsvillensis Foerste, Bull. Sci. Lab. Denison Univ., Vol. 17, p. 122, pl. 10, figs. 15a, b, 1912. Curdsville bed, Glenn Creek Station, Woodford country, Ky.

Shell of medium size, transversely semi-elliptical in outline, ordinarily between 16 and 21 mm. in width and from 9 to 11.5 mm. long; cardinal angles slightly acute, but not produced; surface of each valve marked by exceedingly fine, hair-like, radiating lirae, 5 to 7 of which occur in the space of 1 mm., with every third or fourth liration slightly more prominent than the intermediate ones. The dimensions of three typical individuals are: width, 16.4, 18.6, and 20.9 mm.; length, 9.0, 10.1, and 11.4 mm.

Pedicle valve moderately convex, with regular curvature of surface both longitudinally and transversely; beak and cardinal area conforming to the general *P. sericeus* type; lateral margins converging slightly from the cardinal extremities forward to the mid-length of the valve and then rounding broadly into the anterior margin; a faint, broad, median sinus generally developed in front of the middle of the shell, causing the anterior outline to be straightened or even slightly emarginated.

Brachial valve moderately concave, with curvature of surface and outlines conforming to the opposite valve; a faint, broad, median fold developed in many individuals corresponding to the ventral sinus. "The interior of the brachial valve is thickened near the anterior and lateral margins, the thickening beginning about 2 or 2½ mm. from the margin and extending to within 1 mm. of the latter. However, between the thickened border and the margin of the valve, the shell is much thinner and is traversed, in the same direction as the radiating striae, by a series of short, vascular grooves, of which about 7 occur in a width of 2 mm. . . . The two median ridges separating the two adductor areas usually are prominent and sharp, as in the less mature stages of *P. rugosus,* although sometimes thickened anteriorly. The lateral outlines of the adductor areas tend to be crescentic." (Foerste).

Foerste has called attention to the fact that the oblique wrinkles along the hinge lines of many individuals belonging to this genus are not characters of specific value. Nevertheless, it is evident that certain species show a marked tendency toward developing these wrinkles while others display just as marked an antipathy to them. Among the fifteen specimens referred to *P. curdsvillensis,* for example, only one shows any trace of oblique wrinkles and on it they are scarcely perceptible. Additional characters which distinguish it from allied species are the absence of a mesial fold on pedicle and sinus on brachial valve, the low convexity of pedicle valve, the absence of

cardinal auriculations, the thickened border in the interior of brachial valve, and the sharp prominent ridges along the axial margins of the adductor muscle scars.

Horizon and locality: Lower Trenton limestone; Wolfe Island, Ontario. Stations 224?; 226, and 308.

EXPLANATION OF PLATE.

PRASOPORA SIMULATRIX ORIENTALIS.

Figures 1, 2—Vertical and tangential sections, X 10, of an average specimen. Queen's University Paleontologic Museum No. 1263.

HALLOPORA VARIA.

Figures 3, 4, 5—Tangential, vertical and transverse section, X 10, of the holotype. Queen's University Paleontologic Museum No. 1272.
Figures 6, 7—Two of the plesiotypes, natural size. Queen's University Paleontologic Museum No. 1270.

HALLOPORA OBLIQUA.

Figures 8, 9—Vertical and transverse sections, X 10, of one of the cotypes.
Figures 10, 11—Two of the cotypes, natural size. Queen's University Paleontologic Museum No. 1276.

PLECTAMBONITES CURDSVILLENSIS.

Figure 12—A pedicle valve showing the faint mesial sinus commonly observed on the shells thus identified.
Figure 13—The interior of a brachial valve from the same locality. Queen's University Paleontologic Museum No. 1269.

RAFINESQUINA DELTOIDEA.

Figure 14—A pedicle valve. Queen's University Paleontologic Museum No. 1262.

PLECTAMBONITES PUNCTOSTRIATUS.

Figures 15, 16, 17—Three of the cotypes, pedicle valves. Queen's University Paleontologic Museum No. 1277.

NOTES ON THE LAND MOLLUSCA OF DE GRASSI POINT, LAKE SIMCOE, AND OTHER ONTARIO LOCALITIES.

BY E. M. WALKER, F.R.S.C., UNIVERSITY OF TORONTO.

(*Continued from page* 22.)

22. *Zonitoides arborea* (Say). The commonest of all our land Mollusca, occurring in the woods everywhere, from the tamarack swamp to the hardwood forests. Toronto, May-October; De Grassi Point, April 27th—September; Go Home Bay, July 15th-17th; Giant's Tomb Island, July 20th; St. William's, September 3rd.

23. *Zonitoides exigua* (Stimpson). This minute ribbed species is common at De Grassi Point under leaves and rubbish in the woods. It was also taken at Go Home Bay and the Giant's Tomb Island.

24. *Zonitoides milium* (Morse). Toronto, De Grassi Point and the Giant's Tomb Island, not rare under leaves in woods.

25. *Gastrodonta intertexta* (Binney). Port Rowan, September 2nd, 1915, a single mature specimen; St. William's, September 3rd, a few living specimens and numerous shells in good condition on a steep wooded slope. It was associated here with considerable numbers of *Polygyra thyroides, P. fraudulenta* and *Pyramidula alternata.*

Gastrodonta ligera (Say) has been recorded from Toronto, but I have not seen specimens of it.

LIMACIDAE.

26. *Agriolimax agrestis* (Linn.) This slug is very abundant at Toronto, De Grassi Point, Port Rowan and St. William's and doubtless everywhere in the cultivated parts of Ontario. During the summer only immature specimens were seen at De Grassi Point and they had scarcely reached their full size when I left on September 23rd. Adults are plentiful at Toronto in the fall and may be found in abundance until well into November. They are most plentiful in low, grassy places.

27. *Agriolimax campestris* (Say). Toronto, De Grassi Point, Port Rowan, St. William's. Abundant and generally distributed, occurring with the preceding species and also in woods.

At De Grassi Point these two slugs are particularly numerous about the narrow belt of woods along the shore where *Vitrina limpida* occurred (vide antea). The individuals seen during the summer were mostly immature. Adults are common in the fall until November.

28. *Limax maximus* Linn. A single specimen of this large European slug was found at Toronto by Mr. H. T. White, in 1916.

ARIONIDAE.

29. *Arion circumscriptus* Johnston. This is also a European slug though it has become thoroughly naturalized in the neighbourhood of Toronto, occurring in almost every little patch of woods under logs and rubbish. It is common from spring to autumn.

ENDODONTIDAE.

30. *Pyramidula alternata* (Say). This is by far the commonest of our larger snails and persists longer than most species in small patches of woods and thickets in the environs of the city. Toronto, De Grassi Point, generally distributed in woods. Also found at Go Home Bay, Giant's Tomb Island, Port Rowan and St. William's.

31. *Pyramidula cronkhitei anthonyi* Pilsbry. One of our most abundant species, occurring very generally in low woods at De Grassi Point. Also found at Toronto, Go Home Bay, Giant's Tomb Island and St. William's, April-October.

32. *Helicodiscus parallelus* (Say). De Grassi Point, May 10th —August 25th, not uncommon. Most of my specimens were found in shady thickets or woods of cedar, poplar, elm, etc. It was also taken by Miss Ford at York Mills, north of Toronto, July 22nd, 1 specimen, and at Point au Baril, Georgian Bay, August 11th, 2 specimens.

33. *Punctum pygmaeum* (Draparnaud). De Grassi Point, May 14th—August; Giant's Tomb Island, July 20th. Found on the under surface of decaying leaves in the forest litter, associated with *Zonitoides exigua*. Considerable search was made for this minute species but it was not often taken.

34. *Sphyradium edentulum* (Draparnaud). Several examples of this little pupiform snail were taken at De Grassi Point from the debris in a small grove of cedar, elm and poplar on July 22nd. They were associated with *Vertigo elatior*, *Helicodiscus parallelus* and a few other common species. Another specimen was taken in a somewhat swampy wood on August 15th, and it was again taken on May 5th, 1917.

PHILOMYCIDAE.

35. *Philomycus carolinensis* (Bosc.). This large slug occurs commonly in rotten logs in the hardwood at De Grassi Point, and I found a number of specimens in a wooded ravine at Go Home Bay, July 16th, and on the Giant's Tomb Island, July 20th. It also occurs at Toronto and St. William's. The earliest capture of the adults was that of the Go Home Bay specimens.

Pallifera dorsalis Binney, has been recorded from Toronto but I have not met with it at all.

SUCCINEIDAE.

36. *Succinea retusa* Lea. Very abundant at De Grassi Point in open marshes and readily collected by sweeping the marsh grasses and sedges with an insect net.

36a. *Succinea retusa* var. *decampii* Tyron. Miss Ford collected a number of specimens of this variety from several localities in the vicinity of Toronto (East Toronto, Mimico and Lambton). All were taken during September.

37. *Succinea ovalis* Say. De Grassi Point, May 10th—August 25th, common in low, rich woods; sometimes occurring under bark and rubbish, sometimes on leaves of shrubs some distance from the ground. It is also common at Toronto and a specimen was taken at St. William's.

Two specimens resembling the var. *totteniana* Lea, were found at Toronto by Miss Ford, April 29th (old shell) and June 21st, fresh adult.

38. *Succinea avara* Say. First noticed at De Grassi Point on June 23rd, 1915, but apparently common throughout the summer,

occurring in low woods and along the margins of streams. A pair in copula were observed on May 9th, 1917.

PUPILLIDAE.

39. *Strobilops virgo* (Pilsbry). Go Home Bay, July 16th and 17th, several specimens were taken and it may have been plentiful but was not distinguished from *Euconulus* until examined later. Found in a wooded ravine. A dead specimen was also taken from the drift along the Don River, Toronto, in November.

40. *Acanthinula harpa* (Say). Living specimens and fresh shells, mostly mature, were found in considerable numbers in a sandy pine wood on the Giant's Tomb Island, July 20th. It was not observed elsewhere.

41. *Bifidaria armifera* (Say). Miss Ford has a single specimen taken at Lambton, (West Toronto) from a "dry, rocky flat," September 9th, 1916. It has already been recorded from the Toronto district.

42. *Bifidaria contracta* (Say). I found a few specimens of this species on July 24th under wet logs and stumps on the edge of Wilson's Creek (De Grassi Point), in its upper part where it is a mere brook. One or two others were found in a low wood near the lake shore. At Toronto I found them in much larger numbers along the banks of the Don River, in November.

43. *Bifidaria tappaniana* (C. B. Adams). A specimen, nearly mature, was found in a rich hardwood forest on the Giant's Tomb Island, July 20th. Another specimen, fully mature, was taken at Toronto, from the banks of the Don River in November. A single adult was also found at De Grassi Point.

44. *Vertigo ovata* Say. A single adult was taken at De Grassi Point on August 25th, from a low wood of poplar, cedar, etc., near the lake shore. Another, very nearly mature, was taken from the banks of the Don River, Toronto, in November.

45. *Vertigo ventricosa* (Morse). Several specimens of this species were taken at De Grassi Point at the same spot where *V. ovata* was found. Adults were found during July, August and September. A single specimen was also taken from the drift along the edge of the Don River in November.

46. *Vertigo elatior* Sterki. De Grassi Point, associated with *V. ventricosa* and apparently commoner. It was not recognized as distinct until determined for me by Mr. Bryant Walker.

All of these Vertigos were taken most frequently from under the sides of chips and blocks of wood from a recently felled aspen poplar. A few were also taken from rubbish in a cedar grove, where they were associated with *Sphyradium edentulum*. A specimen of *V. elatior* was

also taken at Toronto in November, from the drift along the shore of the Don River.

47. *Vertigo gouldii* (Binney). A single dead specimen of this form was found at De Grassi Point on July 25th in the hardwood.

48. *Vertigo milium* (Gould). I found three shells of this tiny form, one of them fresh, at De Grassi Point on May 14th, 1917. They were taken from the forest litter at the edge of a low wood and were associated with *Carychium exile canadensis.* It has also been reported from the Toronto district.

The determination is my own and has not been verified, like the other species of Vertigo, by Mr. Bryant Walker.

COCHLICOPIDAE.

49. *Cochlicopa lubrica* (Muller). Common at Toronto where I have taken it in May and October. On October 10th, 1915, I found it in considerable numbers among the fallen needles and other debris at the edge of a pine grove in Wychwood Park. Miss Ford has specimens from Mimico, September 9th (1 specimen from dry, stony hillside); East Toronto, September 30th (5 adults and 3 young from beneath stones) and Rosedale, October 5th, (7 specimens from a wooded ravine.

Two specimens were also taken on the Giant's Tomb Island, July 20th.

49a. *Cochlicopa lubrica* var. *morseana* Doberty. De Grassi Point, August 19th, a single example from the hardwood. Another was taken by Miss Ford at Toronto ("old Belt Line Cut," under damp log, June 21st).

VALLONIIDAE.

50. *Vallonia pulchella* (Muller). Abundant at Toronto, April-November, occurring under stones, boards, etc. in more or less open places. In early November I found a considerable number crowded together under a chunk of wood which was half buried in the sand near the edge of the Don River. It is one of the few species which continues to thrive under urban conditions.

It was also common at De Grassi Point, in more or less grassy places, occurring plentifully throughout the summer.

51. *Vallonia costata* (Muller). Lambton (West Toronto), under dry log, September 4th, 2 specimens (Miss Ford); Rosedale, under dry log in ravine, October 5th, 1 specimen (Miss Ford).

AURICULIDAE.

52. *Carychium exiguum* (Say). Numerous dead specimens of this minute form were found in November in the drift along the Don River, Toronto. Living specimens were also found in wet depressions in a hardwood forest near St. William's, September 3rd. A few occurred at De Grassi Point, associated with the next species.

53. *Carychium exile* var. *canadense* Clapp. This little mollusk is extremely common at De Grassi Point, April-September, in wet places in the woods. It was first found in the moss of the tamarack swamp, but is much more easily collected from the under sides of leaves in damp depressions in deciduous woods. Dead shells were found with those of *C. exiguum* at Toronto in November.

PELORIA FLOWERS ON IVYWORT OR IVY-LEAVED TOADFLAX.

[*Linaria Cymbalaria* (L) Mill.]

This Toadflax is a trailing plant, native to Southern Europe, where it is said to be used as a salad. I have found it wild, as a colonist, in England, growing on such ruins as St. Mary's Abbey, Yorkshire, and the Roman camp at Lanchester, County Durham: it is, however, rare. The flowers are somewhat small, streaked with lilac and yellow, and of a personate or 'snap-dragon' form, but in a fine clump growing in my window box, in the beginning of March, I noticed a flower which was regular, with 5 spurs, 5 corolla lobes, and 5 stamens. This is the peloria form of flower, which has sometimes been found on *Linaria vulgaris*, but has not, as far as I am aware, been recorded for this species. The French proverb says, 'The English are troubled with afterthought' and doubtless it would have been better if, instead of dissecting it, I had tried to secure the seed, to attempt the propagation of this abnormal form. Another *Linaria* (*L. Dalmatica*) which I have grown here, exhibits the peloria form at the summit of each flower spike.

BLYTHE HURST, Charlottetown, P.E.I.

DISAPPEARANCE OF THE BLUE GRAY GNAT-CATCHER.

To the bird student who is continuously resident in one place comes the opportunity of noting the comparative abundance of a species in different years and to him falls the problem of the reasons for variation in numbers, which is usually baffling.

Around London, Ont., we have been interested in watching the increase of the grasshopper sparrow, cardinal, short-billed marsh wren,

the latter perhaps the most erratic of all birds, and for the last two years we have been amazed and puzzled by the dwindling of the blue gray gnat-catcher. I have seen it so common in this district that I was able to find on one morning three nests in a single wood. Last year my impression is that the combined efforts of our Club resulted in the report of one bird and this year not a single one has been noted. These birds usually nest in half open woods of oak, cherry, elm, etc., and we have usually found in the same woods the cerulean warbler and often the goldenwing but while the numbers of the two last mentioned have not fallen away seriously, the blue gray has vanished as far as our district is concerned.

It is a well known fact that practically all of the annual increases of each species dies within a year but when the blue bird was almost exterminated in the winter of 1895 it proved to be possible for that species to hold a considerable portion of the annual gain of numbers so that in a few years it nearly reached the former standard of abundance and it is to be hoped that there are enough gnat-catchers left in Ontario to spread gradually over their former habitat.

W. E. SAUNDERS, London, Ont.

THE ROUGH-WINGED SWALLOW NEAR OTTAWA.

On June 28th, two tunnels used by Rough-winged Swallows as nesting sites were observed about one-half a mile apart in the sandy bank of the Rideau River above Hog's Back Lock. They were larger in diameter than those excavated by Bank Swallows, being about the same size as Kingfisher tunnels.

One of them, situated about two feet from the top of a thirty foot bank, was found to run in three feet and end in a chamber approximately eight inches in diameter. The nest, which contained six young, was made entirely of a liberal amount of dry grass. Instead of being symmetrically placed at the end of the tunnel, the nesting chamber was, without apparent reason, wholly on one side.

The Rough-winged Swallow has uniformly colored throat and breast while the Bank Swallow, which it resembles in appearance and habits, has white underparts with a brownish band across the breast. The flight of the Rough-wing is slower and less irregular than that of the Bank Swallow.

The Rough-winged Swallow should be watched for, as it has seldom been observed in eastern Canada.

CLYDE L. PATCH, Ottawa.

NOTES.

The daily papers reported that Vilhjalmur Stefansson, the Arctic explorer, was wintering with the gasolene schooner Polar Bear at Prince of Wales Strait, according to news brought by a Northwest Police expedition from Fort McPherson. Stefansson, who passed last summer exploring the new land discovered north of Prince Patrick Island, was hopeful that the ice would break up early the past spring and permit him to make the northeast passage and to sail up the St. Lawrence River to Montreal.

Eight new club members were secured in one of the Government buildings at Ottawa in two hours by a self-appointed committee of two of our members. Persons were found to be anxious to be elected to membership. Make up a list of your friends or take an attendance list of the employees in a department, ask each one if they wish to become a member, and send the names and addresses of those who do to the Secretary.

A number of rats which were stunted for various periods of time at the Connecticut Agricultural Exp. Station and Sheffield Scientific School, New Haven, Conn., showed that this retardation of growth tended to prolong their life beyond the average span; that is, physiologically age is not a function of time alone but also of growth. A rat three years old may be regarded as corresponding to a man ninety years old. Although none of the stunted rats began breeding until they had reached an age when normal rats are commonly believed to be approaching the menopause, they produced from three to six litters of young and successfully reared all but a few of them. Their young were apparently as vigorous as those born of younger mothers. Hence the menopause has been postponed long beyond the age at which it usually appears. In view of this, and the added fact that less than one-third of the stock rats reached an age of more than two years, whereas all of these stunted females lived longer, it appears as if the preliminary stunting period lengthened the total span of their life.

A third relief expedition will be sent to the Arctic this summer by the American Museum of Natural History to bring home the members of the Crocker Land expedition, which went north in 1913. The second relief ship, the Danmark, was reported in Melville Bay, 150

miles southeast of Cape York, on August 20, 1916. She probably reached North Star Bay at least and probably has the explorers on board. The third vessel will be sent to Etah, leaving St. John's early in July. The committee hopes to obtain a Newfoundland sealer for this purpose and to bring the Crocker Land expedition back to Newfoundland late in August.

For the third consecutive year a collector of plants has been put into certain of the northern counties of the State of Wisconsin by the Public Museum of the City of Milwaukee, devoting all of the season to the collection of plants of the regions. This work is toward a plant census of the State, on which the Museum has been working for several years.

According to the "Museums Journal," sanction has been given by the War Cabinet of Great Britain to establish a National War Museum and "a committee has been formed to carry it into effect." "The object is to collect and preserve for public inspection objects illustrating the British share in the war." The Tower of London has been suggested as an ideal place for such a "national storehouse of British Military History."

The Fisheries Branch of the Department of Naval Service, has recently published a supplement to the Sixth Annual Report, containing the following contributions to Canadian Biology: "The Winter Plankton in the neighborhood of St. Andrews, 1914-15," by Prof. J. Playfair; "Diatoms and Lobster Rearing," by Prof. W. T. MacClement; "On the Scales of the Spring Salmon," by Dr. C. McLean Fraser; "On the Life-history of the Coho," by Dr. C. McL. Fraser; "An Investigation of Oyster Propagation in Richmond Bay, P.E.I., during 1915," by Dr. J. Nelson; "The Marine Algæ of the Passamaquoddy Region, N.B.", by Prof. A. B. Klugh; "On Serially Striped Haddock in New Brunswick," by Prof. E. E. Prince; "Notes on the Phyto-Plankton of the Bay of Fundy and Passamaquoddy Bay," by Prof. L. W. Bailey; and "The Geological Features of the St. Croix River and Passamaquoddy Bay," by Prof. L. W. Bailey.

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THE PURPLE MARTIN.

By Charles Macnamara, Arnprior, Ontario.

None of the higher forms of our wild life have adapted themselves so readily to the changed conditions brought about by the advent of the white man to America as some of the birds. In general, the culture our ancestors brought from Europe has been destructive of almost all the indigenous animals; most of the mammals are approaching extinction while of the birds, two or three species are already exterminated, and a number of others are fast disappearing. But in marked contrast to these, a few species of our avian fauna have known not only how to resist our deadly encroachments, but appear in some ways to have actually benefited by the new conditions. One curious illustration of this is afforded by the nest of the chipping sparrow, which nowadays is invariably lined with horsehair. No doubt the bird originally used some vegetable fibre for the purpose, but when horsehair became available it took exclusively to that superior building material.

It is, though, in the choice of a nesting site that the adaptiveness of certain birds is best seen. Besides the several species, such as the robin, the phœbe and the wren, which, while still nesting freely as of old in the fields and woods, often delight us by the confidence with which they build around our houses, there are others that have become almost wholly dependent on man for their domicile. One of these is the chimney-swift. In these latter days the swift nearly always glues its curious bracket of dry twigs inside a disused chimney. Very seldom is the bird seen at any distance from a house, and when it is found ranging over the forest, its nest is almost certain to be discovered on the inner wall of a deserted shanty or shed.

Even more dependent on man is the purple martin. Its original practice is disclosed by the fact that, in the western part of its range, where human habitations are rare, it still sometimes nests in cavities in trees. But in the east it looks exclusively to man for accommodation. I have seen it occasionally rearing its brood on some shelf-like

eave or house cornice, but for the most part it relies for its nesting places on man's direct bounty in the shape of boxes or houses specially provided for it, and it has, throughout the eastern United States and Canada, practically forsaken its primitive nesting habit.

For a good many years, I have had a martin house on the gable end of an outbuilding overlooking the square grassy yard at the back of our house. It has accommodation for eleven families, and is usually all taken up every summer. Sometimes in the early spring, before the martins have come, a pair of English sparrows decide that this is just the home they have been looking for, and begin to carry in great quantities of straws, sticks and feathers. Then when the rightful occupants of the house arrive, a fierce battle breaks out and rages for several days, but always ends by the sparrows being evicted, and their nesting material contemptuously cast forth. One year, however, the pertinacity of a particularly obstinate pair of sparrows finally wore out the martins, and the interlopers were permitted to occupy one of the lowest corner apartments. Considering that the whole vast countryside was open to them, the site seemed to be a poor choice for the sparrows; for their sufferance in the house was of the most intolerant description. They were continually harassed by the martins as they passed in and out of their nest, and were never permitted on any account to rest for a single second on the gallery in front of their door. It was comical to see how cautiously they had to approach the house, hopping with great circumspection from roof to roof of the adjoining buildings, and then while still some distance away, dashing straight into their compartment, too quickly for the martins to get a peck at them. But in spite of all their hardships, they managed to rear their young.

It may be worth while here to remark that while the pugnacious English sparrow is often and justly blamed for driving away many of our smaller native birds, it does not always succeed in its nefarious projects in this respect. A friend tells me that a pair of sparrows built this spring in a box in his garden usually occupied by a family of house wrens, and the young sparrows were hatched shortly before the wrens returned from the south. But the wrens were not to be dispossessed so easily. Immediately on their arrival, they opened an attack of such sustained ferocity, that the sparrows were driven off, their nest broken up, and their naked young ruthlessly tumbled out onto the ground.

The purple martins reach Arnprior on their spring migration about the middle of April. The average date for the last six years, as given me by Mr. Ligouri Gormley, is the 14th. But while they may be seen around the town as early as the 9th or 10th, it is a remarkable fact that for five years past, during which I have kept a record, the first of them have—with one exception—always taken up their

quarters in my bird house on the morning of the 19th of April. The exception was in 1916, when they came on the 18th April. But 1916 was a leap year, and it would seem that the martins' calendar ignores the intercalary day of the 29th February—you can scarcely expect birds to go into such refinements in the computation of time, and the day we humans counted in 1916 as the 18th April was really the 19th for them! I feared that this lost day might destroy their subsequent record for punctuality, and I anxiously awaited their arrivel in 1917. They had not put in their appearance by the 18th, and as soon as I awoke on the morning of the 19th I hurried to get a view of the bird-house. There to my delight were three tired-looking martins—two glossy blue males and a grey-breasted female—resting silently on galleries of the house.

But while the first-comers arrive so punctually, it is usually a week or ten days later before the house receives its full complement of tenants. The upper compartments are the preferred ones, and are invariably taken up first. When any are left unoccupied, it is always some on the lower floors. Nesting thus in colonies is not really natural to the martins. While they have been quick to adapt the gregarious habit, they are as yet anything but sociable, and are continually squabbling. A great deal of their lovely liquid warbling that charms us so much is really abuse of the neighbors. Each household is exceedingly jealous of its territorial rights, and instantly resents any encroachment on its part of the verandah, fiercely threatening the trespasser with open bill. Assault soon culminates in battery and the combatants tumble off the gallery, and fight it out in the air. They are decidedly noisy birds, and I can easily understand how annoying a colony of them might be to anyone who is not fond of birds. I remember a visitor who had occupied the "spare room," which looks toward my martin house, asking rather querulously at breakfast, "What are those black birds at the back of the house?" I fear they had kept him awake from some unconscionable hour of the morning. But just as the honest bark of YOUR dog cannot possibly annoy anyone, and it must be the howling of the miserable cur next door that keeps the neighbourhood awake; so to the true bird-lover, the piercing trills and loud warblings of the purple martin are delightful sounds, even at four o'clock in the morning.

The nest consists of a few perfunctory straws, and usually four eggs are laid, the time of incubation being from twelve to fifteen days. One year the female of the pair occupying apartment No. 6 of my house was accidentally killed not long after the breeding season had begun. I felt sorry for the poor widower, and wondered what would become of him. To my surprise, in a few days he had another mate. Whether he had picked up an unattached female somewhere, or had eloped with some one else's wife, I had, of course, no means of know-

ing; but probably there is always an occasional spinster or bachelor bird fated to spend the summer alone unless some such accident as this provides a mate.

Some of the birds meet their affinities much sooner than others, for the first young of the colony are out two weeks before the last broods are hatched. By the first of July most of the doors are crowded with little heads, and the whole front of the house blossoms suddenly with enormous yellow mouths whenever an old bird sweeps in with its beak full of insects. Numerous counts made at different times of the day during the first two weeks of July, 1917, showed that, with remarkable regularity, a parent arrived with food every thirty seconds. This year nine pairs occupied the house, and assuming that each pair had four young, and that they were fed in turn, then each nestling was fed every eighteen minutes. A similar count for a whole day, from 4 a.m. to 8 p.m., cited in Chapman's Handbook of Birds of Eastern North America, when reduced to the same basis as my results, gives a feeding every twenty minutes. This is the colony's busiest time, and the strain begins to tell on the old birds, their glossy plumage becoming dishevelled and soiled. As the young grow up, however, they are not fed so often. After the middle of July the pace slackens considerably, and the old birds have more time to sit around on the verandahs and nearby trees, and gossip and scold.

The martins usually fly high but they do not hunt far afield, and my colony can generally be seen hawking within a radius of a quarter of a mile from their home. They appear to find ample food in this comparatively small area,—an indication of the large number of insects that must frequent the upper air. A considerable proportion of their prey seems to consist of dragon flies. Now the purple martin stands very high in the list of birds useful to mankind, but in destroying the rapacious and carnivorous dragon fly, it cannot be said to be conferring any favor on us. The truth is, in order to determine the value of any species of bird to man, it is necessary to open an account with it, debiting it on the one side with the beneficial insects it consumes, or the toll it levies on our vegetables or cultivated fruits, and crediting it on the other side with the noxious insects or weed seeds it destroys. When this is done, very few birds will be found without a large balance to the good; and I doubt if we should be able to refuse even the cheque of the English sparrow with the excuse of "no funds."

Besides the supply of food to the young, a very important duty of the parents is the removal of excremental matter from the nest. As they leave after feeding their brood, they almost always carry away a dropping enclosed in its gelatinous sac, generally conveying it some distance from the nest, but sometimes letting it fall alarmingly close to the inoffensive observer. Once or twice a mother was seen to dispose

of the morsel by swallowing it: a higher example of maternal devotion would be hard to find.

One purple martin looks very much like another, and it is, of course, on their essential resemblances that the species is founded. But the close study of any species of animal always discloses more or less marked differences between individuals, not only in structure and appearance, but in temperament also. It is said that individuality can be noticed in creatures as low in the scale of life as the annelids, and that earthworms display marked idiosyncrasies of conduct. If this be true, we may confidently look for decided variations in the mental traits of purple martins, and an incident I observed this year seems to confirm the expectation.

The guiding principle of the purple martin ethic is a virulent family egoism. Charity both begins and ends at home, and all there ever is to spare for a neighbour is a peck or a curse. But while watching the young birds being fed, I remarked an astonishing exception to this rule. On three different occasions, the father of apartment No. 5 was seen, after he had rammed a few insects into the gaping mouths of his own off-spring, to bestow the rest of his beakful on the young of apartment No. 4 next door, who, in the general habit of all young martins, always reached out long eager necks and clamored for food when they saw their youthful neighbours being fed. This behaviour of father No. 5 was unique. Not the smallest spark of generosity was ever seen to warm the frigid selfishness of any of the others: and the question is: did this action presage the dawn of a martin altruism, or was father No. 5 merely too stupid to distinguish his neighbour's young from his own? Optimists will adopt the first alternative, pessimists the last.

Shortly after the middle of July, some of the young begin to creep out onto the verandah: and now it becomes plain that my bird-house, although built on an approved plan, does not sufficiently imitate the deep cavities in trees that are the birds' natural habitations. For the adventurous nestlings, crawling out too soon from the shallow cabins of the house, accidentally tumble off the verandahs, or launch out before they can fly properly and come piteously to the ground, where they fall an easy prey to prowling cats. We always keep a lookout for these rash youngsters, and either put them back into their nest, or if they are nearly fledged, place them on the branch of a tree, where the old birds feed them for a day or two until they can fly. But in spite of all our care, the cats get four or five of them every year.

As soon as the fledglings can take the wing, the whole family leaves the house for good, and during the rest of the season spends the nights in the tree tops. By the first of August all are flown, and the house is empty. For about three weeks after this they may still be seen hawking in flocks of four or five—probably family groups—and

continually calling to one another with plaintive notes. Rarely a pair may pay a flying visit to the house, and sit and warble a minute on the galleries as of old. But towards the end of August the whole tribe leaves for the palms and temples of Central America, and my martin house is silent and deserted for another year.

ALBERNI NOTES (BOTANY).

By J. K. HENRY, VANCOUVER, B.C.

The purpose of this paper is to indicate, rather than to discuss in any fullness, the floral riches of the very interesting district between Cameron Lake and Anderson Lake, Vancouver Is.; to make a small contribution to Mr. J. M. Macoun's "Addition to the Flora of Vancouver Island"; and to describe a few new forms. It is not supposed that all the plants in the brief lists are now collected for the first time, though with the exception of those in the first two lists, they have either not been definitely listed, or have been referred to other species. The grasses were determined for me by Prof. A. S. Hitchcock and the sedges by Mr. K. K. MacKenzie.

Alberni, (Lat. 49° 15′ N.) which lies in the centre of the district, unites north and south alpine and maritime, in its flora. Here, as Prof. John Macoun discovered years ago, is the northernmost station of *Lilaea subulata* H.B.K. and *Juncus supiniformis* Engelm., both of which occur in California but not in Washington. Not very distant, at Ucluelet, is the southernmost station of *Vaccinium Vitis-Idaea* L., a distinctively northern plant.

The following alpine or sub-alpine plants occur practically at sea-level (below an altitude of 200 ft.):—

Listera caurina Piper, Alberni, (W. R. Carter and J. K. Henry).
Tiarella laciniata Hook. Alberni, (W. R. Carter).
Epilobium lactiflorum Reich. Anderson Lake, (W. A. Newcombe).
Pedicularis racemosa Dougl. Hidden Lake, (W. R. Carter).
Phlox diffusa Hook. Anderson Lake, (W. A. Newcombe).
Arnica latifolia Bong. Anderson Lake.
Erigeron salsuginosus Gray. Anderson Lake.

The following plants, (the list is merely suggestive) mostly rare or not often seen in southern British Columbia, occur at Alberni or in its neighborhood:—

Isoëtes Nuttallii A. Br. (Cat. Can. Pl.)
I. maritima Underw. (Cat. Can. Pl.)
Limosella tenuifolia Wolf.

Montia Chamissoi (Ledeb.) D. & J.
Pleuricospora fimbriolata Gray, (W. R. Carter).
Newberrya congesta, Mt. Arrowsmith, (W. R. Carter).
Subularia aquatica L. (Cat. Can. Pl.)
Erythronium Smithii Hook.
Verbena hastata L. (W. R. Carter).
Elatine americana (Pursh) Arn. (Dr. C. F. Newcombe).

The following plants not hitherto reported from Vancouver Island have been recently collected by Mr. W. R. Carter:—

**Corydalis Scouleri* Hook. Nitinat. Ap. 28. 1915. Det. by Dr. C. F. Newcombe. New to Canada.

**Pedicularis ornithorhyncha* Benth. Mt. Arrowsmith. July 24, 1915. Det. by Dr. C. F. Newcombe. New to Canada.

Apocynum cannabinum. (The form sometimes distinguished as *A. Suksdorfii*) Cameron Lake.

Potentilla dissecta Pursh. var. *glaucophylla* S. Wats. Mt. Arrowsmith.

Antennaria parvifolia Nutt. (?) Mt. Arrowsmith. Differs from the common B. C. form in its yellowish, but acute, tegules.

Erigeron salsuginosus Gray. var. *angustifolius* Gray. Mt. Arrowsmith (?)

Mitella caulescens Nutt. Alberni.

Prunella vulgaris L. var. *lanceolata* forma *candida* Fernald Port Alberni. Not rare.

Euphorbia hirsuta (Torr.) Wiegand. Sproat Lake; introduced.

Lythrum Salicaria L. var. *tomentosum* (Mill) DC. Salt marsh. Alberni; introduced.

Trifolium arvense L. Englishman's River; introduced.

Hypopitys brevis Small. Beaufort Range. Distinguished from *H. Hypopitys* L. by the strongly funnel-form stigmas which seem to characterize all our western species.

The following plants were collected by the writer near Alberni in June, 1916.—

Melica Smithii (Porter) Vasey. Alberni.

Melica Geyeri Munro. Alberni. The range of this grass is said to be California to Oregon. If it occurs in Washington, it has not yet found its way into the floras.

Glyceria leptostachya Buckl. Alberni.

Carex obnupta Bailey. A little-known plant in southern B.C.; differing from *C. magnifica* Dewey (*C. sitchensis* of authors) in its more slender spikes. Low ground, Port Alberni, apparently rare.

Carex praticola Rydb. Dry woods, Alberni.

*Dr. C. F. Newcombe informs me that both of these plants were collected by Mr. J. M. Macoun during the season of 1915 at possibly earlier dates. The Pedicularis was also collected in 1915 on the mountains near Squamish.

Carex feta Bailey. Plentiful on the cleared townsite, Port Alberni.

Montia diffusa (Nutt.) Wolf. A few plants only, to which my attention was directed by Miss M. E. St. G. Mahaffy, M.A., perhaps introduced.

Viola pallens (Banks) Brainerd. Hidden Lake; fruiting plants only, but matching specimens from Vancouver city so det. by Prof. Brainerd. Our western plant differs from the eastern in its smaller size and brown seeds.

Limosella tenuifolia Wolf. With *Lilaea subulata* near the mouth of the Somas River; best distinguished from *L. aquatica* by its much stouter petioles and slightly fleshy blades.

Veronica scutellata L. var. *villosa* Schum. Stems densely soft-pubescent (not pilose). This var., according to Gray's New Manual, is introd. in Eastern America. It is undoubtedly native at Alberni and probably so at New Westminster. Det. by Prof. Macbride of the Gray Herbarium.

Sisyrinchium segetum Bicknell. Somas River above the falls; Cameron Lake. (W. R. Carter).

Castilleja Dixonii Fernald. Salt marshes, Prince Rupert to Wn. Merely a thick--leaved halophytic form of *C. miniata* Dougl.

Grindelia oregana Gray and the var. *Wilkesiana* Piper. Salt marshes, Alberni Canal.

Variation is very marked in the plants of the West Coast. Mr. Carter showed me the following albinos.—

Allium cernuum Roth;
Camassia quamash Greene;
Calypso bulbosa (L.) Oakes;
Rubus spectabilis Pursh;
Ribes Lobbii Gray;
Gentiana sceptrum Griseb.

And the following with double flowers.—

Rubus spectabilis Pursh;
Rubus macropetalus Dougl.;
Trillium ovatum Pursh;
Claytonia lanceolata Pursh.

Most of these variations are rare and only call for passing notice. Color variations are, however, as Prof. Macbride has recently pointed out, of great interest to the collector, and, when not uncommon, deserving of recognition. The following may be noted.—

Allium cernuum Roth. *forma alba* f.n. Perianth white. Mt. Arrowsmith where it has been collected on several occasions by Mr. W. R. Carter.

Veronica americana L. forma *rosea* f.n. Corolla pink. Port Alberni; not uncommon at Crescent, B.C. (near Blaine, Wn.) A striking form always clearly distinct from the species.

Camassia quamash Green forma *albiflora* f.n. Perianth white. Common, brackish marshes. Alberni; rare about Victoria; also in Wn.

The following new varieties and species may be noted:—

Erigeron philadelphicus L. var *glabra* v.n. Plants 2-7 dm high; stems nearly glabrous or somewhat hirsute; leaves thick, nearly or quite glabrous, denticulate to sinuate-denticulate; tegules sometimes purple-tipped, not hirsute. Salt marshes, Murdoch's Landing and Alberni. It bears much the same relation to the species as *Castilleja Dissonii* Fernald to *C. minuta* Dougl.; *i.e.*, it is probably a holophytic form. It differs mainly from the species in its thick glabrous or glabrate leaves.

Aster Carteriana s.n. Stem slender, usually leafy to the top, rather softly herbaceous especially above, 2-6 dm. high, simple or usually with 3-6 comparatively long erect branches each terminating in a solitary head; the short pubescence of the stem uniform above, in lines below; leaves usually entire, sometimes serrate at the middle, very thin, glabrous except for occasional cilation at the base and the single scabrous-ciliolate line on the margins, rather dark-green, narrowly oblong or narrowly lanceolate, the largest 7-12 cm. long and 5-7 mm. wide, mostly slightly narrowed to a sessile base, the apex pungently indurated, the lowest more or less withered at flowering and some of them somewhat petioled; heads 3.5-5 cm. broad, the tegules usually very leafy and often exceeding the rays, like the leaves in texture margin and apex, but also often smaller, 6-9 mm. long, erect subequal, more or less scarious towards the base, loosely imbricated, lanceolate, glabrous except on the short-ciliolate margin, apex pungently tipped; rays blue, the limb 15-20 mm. long; pappus brownish-white; achenes very pubescent. Common along the outer edge of stony and gravelly shores, Cameron and Horne Lakes, Vancouver Island; W. R. Carter's Nos. 225, 226, Sept., 1916. Distinguished from such related forms as *A. foliaceus* (Gray) Howell, and *A. Douglasii* Lindl. by its solitary heads at the end of the long erect branches, the lower habit, the thinner leaves, the often more foliaceous tegules, and the longer rays; in foliage not unlike *A. microlonchus* Greene, from which it differs in the smooth leaf-surface, the much longer rays, and the very different tegules; nearest *A. Douglasii*, but with a different habitat, thinner leaves, larger heads, etc.

The following changes in nomenclature are suggested:—

Allium Watsoni Howell (*A. vancouverense* Macoun, Cat. Can.Pl. iv. 39). Through the kindness of Prof. A. R. Sweetser, of the University of Oregon, I have been able to compare the plants which have borne the above names. As the flowers of the Mt. Arrowsmith plants were young and those of the Oregon plant mature, the former, in their slightly longer and narrower perianth-segments, seemed at first sight to be different; but a few more mature flowers showed no essential

difference. The plants have the same general appearance. They are clearly distinct from *A. falciforme* not only in their more slender habit and smaller flowers, but in having stamens about two-thirds as long as the perianth-segments; whereas in *A. falciforme* the stamens are less than one-half as long as the segments. As unfortunately Prof. Macoun never published a description of *A. vancouverense*, this name must be replaced by *A. Watsoni* Howell.* Another species is thus added to the short list of plants found in Oregon and Vancouver Island but not in Washington.

Sisyrinchium idahoense Bicknell var. *birameum* (Piper) New Comb. Usually taller than the species; branching above, the two branches subtended by a leaf, or the stem often strongly geniculate with a leaf at the joint; the bracts, as compared with those of the species, often subequal.

When Prof. Piper first published his *S. birameum* (Contrib. U.S. Nat. Herb. vol. xi., pg. 203) he was doubtful whether it was distinct from *S. idahoense;* but in a recent book his doubts have disappeared and it is placed on an equality with that species. That it is, however, a variety appears from the following observations based on Alberni plants: The plants are intimately associated. Straight leafless stems, straight stems with a single leaf above, geniculate stems with a leaf at the joint, and branching stems all grow together. Branching and simple stems may occur in a single tuft. All the forms have the same tendency to darken in drying. While the bracts of the branching forms are often subequal, they may also be very unequal (24 and 44 mm. in one specimen and 23 and 38 mm. in another). The leaves of unbranched plants may be as long as the stem and of branching hardly half as long.

CANADA AND UNITED STATES WILL PROTECT BIRDS.

The International Convention for the protection of migratory birds in Canada and the United States, ratified in December last, constitutes the most important and far-reaching measure ever taken in the history of bird protection. It affords the best means of ensuring not only a cessation of the decrease in the numbers of our migratory birds such as the insectivorous birds, the wild-fowl, waders and sea birds, but, in many cases, it assures an increase in their numbers, which have been ruthlessly depleted. It affects over 1,000 species of our chief insect-eating and game birds. It guarantees to the farmer the continued existence of the insect-eating birds, the most powerful

*Prof. Sweetser, to whom I sent specimens of the Mt. Arrowsmith plant, writes: "From what we have been able to do with it, should say you are justified in thinking this the same form as A. Watsoni Howell."

and active allies he has in the fight against the destroyers of his crops; and it guarantees to the sportsmen a never-failing supply of ducks, geese, and other game birds.

In the fulfilment of its obligations under the Convention, the Canadian Government introduced the Migratory Birds Convention Bill to carry out the provisions of the Convention, and this measure received Royal Assent on August 31st, and is now law. It is expected that the Regulations under the Act will shortly be promulgated.

In the case of insectivorous birds, it will be unlawful to kill them or to take their eggs at any time of the year. The close seasons on ducks and geese will not exceed three and one-half months, and the dates of opening and closing will be fixed in accordance with local conditions and after consultation with the proper authorities in the different provinces. On a number of birds, such as the cranes, swans, curlew and most of the shore-birds, with the exception of woodcock, snipe, certain plover and yellow-legs, which are becoming greatly reduced in numbers, a close season of ten years will be provided. The wood duck and eider duck will also be given special protection. Where they are injurious to agricultural or other interests, provision will be made for the killing of protected birds under special permit. Regulations will also be made to prohibit the shipment of migratory birds or their eggs during the close seasons and generally to govern the traffic in them and their eggs.

While the numbers of the migratory birds in Canada and the United States have been most seriously depleted by various causes, confidence is felt that, with international co-operation, and, particularly, the prohibition of spring shooting, a gradual increase in the abundance of our wild bird life will take place.—C.G.H.

THE WIDESPREAD INFLUENCE OF THE CHILDREN'S MUSEUM.

There are indications that men and women of the United States and of several foreign countries are becoming more and more interested in the establishment of Children's Museums. And if the results which in the past have followed similar manifestations of interest can be regarded as indicative of things to come, there is reason to believe that a good many such institutions will be added to the fraternities of Museums within the next ten years.

The Children's Museum of Boston, founded in 1912, had been in the minds of a considerable number of public spirited Bostonians for several years before it became an actual fact. Similarly the Children's Museum which is soon to become a part of the new Cleveland Museum of Art, has been contemplated by the Director of the

Museum and other citizens of Cleveland for more than three years. And now the Municipal Museum in Wellington, New Zealand, having followed through the British Journals the progress of Children's Museum development in the United States,has taken its initial step towards a Museum for children by discontinuing its organization for adults and perfecting plans for reopening as a Children's Museum when the war ceases.

From no less than five different parts of the United States, men and women are now calling upon the staff of the Brooklyn Children's Museum for information to be used for arousing interest in the establishment of other Children's Museums. In one city a building has been secured and funds are being raised for the organization of a permanent Museum Association. Prominent citizens of another city have asked officers of the Brooklyn Children's Museum to outline a plan of Children's Museum work that can be immediately started in a building recently obtained for the purpose. For another locality they have submitted floor plans of a new Children's Museum Building together with a written outline of the character and scope of work which could be profitably undertaken.

More significant possibly than any other indication, is the fact that college students are presenting for class discussion original essays dealing with the conditions and progress of Children's Museums. Indeed, the subject has become of sufficient importance to cause one college to write for information concerning the requirements of training and preparation for college students who desire to engage in Chldren's Museum work.

HARLAN I. SMITH.

NOTES FROM THE JOURNAL OF WILLIAM POPE.

In 1833, Mr. William Pope left England for Canada and after spending some time investigating the counties of Elgin and Norfolk, he made his home near Port Ryerse.

Through the kindness of his grandson Mr. Thomas Pope, of that village, I am permitted to make extracts from his writings.

The journal and diary which have come into my hands cover a period of less than two years, but they throw a great deal of light upon the conditions among the wild things in those days

W. E. SAUNDERS.

Having determined on paying a visit to America with the intention of settling in Canada provided I liked the country and found things as prosperous and flourishing as they are represented to be, I engaged a berth in the packet ship Ontario (500 tons, Captain Sebor)

lying in St. Katherins Docks and for which said berth I paid 35 guineas. Accordingly on Good Friday, 28th March, we left the City and were towed down the River by two steamers as far as the Hope where we cast anchor for the night.

We had rather boisterous and contrary winds for two days in passing the Downs, which helped to break me in a little for the sea, and I suffered in common with the rest of the passengers, the greater part never having been to sea before.

We touched at Portsmouth on the 31st and arrived at Plymouth in the evening of the same day. We stayed all night here and departed on the next day about 12, the wind being quite favorable.

About ten miles from land a little bird called the Titlark came flying around the ship. I saw a great many white gulls and several species of divers. On the 2nd April we met the Lady Melville, East Indiaman, returning home. We passed within a quarter of a mile of the Eddystone Lighthouse and the same evening after running by the Lizard at the rate of ten knots an hour we bade farewell to Old England, upon whose weather beaten cliffs I stood gazing with a lost lingering look until they disappeared in the distance.

We now had for several days a most favorable breeze chiefly going at the rate of 9 or 10 knots an hour, which is considered very good sailing. On the 7th a couple of Martins came to the ship and settled on the rigging. They stayed some time with us and left during the night. They were evidently on their route to some northern clime. On the 9th we spoke the Brig Merope, of Poole, bound for Quebec.

On the 10th we met with three of those magnificent though dangerous pieces of so called icebergs. Two we saw in the morning, one of which was very similar in shape to Westminster Abbey, though far exceeding it in magnitude. The other we passed about ten o'clock at night. Lat. 44-0. Lon. 44-28. They are beautiful in the extreme when the sun is shining on them giving them most splendid colors, such as would defy all the powers of art to imitate, tints of the richest blue and green contrasted with the purest white. I was much gratified at the sight. They have a very great influence on the atmosphere in their immediate neighbourhood, causing a great degree of coldness, as was sufficiently proved in this instance by the thermometer falling 6°. It is from this fact that navigators are able to judge of their vicinity in thick cloudy or foggy weather.

Up to this time the wind was very favorable, so much so that if it had only continued for four days more we should have been at New York and should have made the quickest passage ever known. We should have made it in thirteen days. We were all now in the highest glee looking forward to the speedy termination of our voyage and discomforts but alas! all our hopes and prospects were suddenly overturned. We were not destined to be so lucky as to make our way

across the trackless Atlantic without encountering a little of the rage and fury of its deceitful bosom. On the evening of the 10th, the day we saw the icebergs the atmosphere became overclouded and the wind after shifting round to the north-west began to blow rather stormy.

There was now every appearance of bad weather approaching and indeed before morning the wind from blowing hard increased to a regular gale, and for the space of eighteen days we scarcely did anything else than beat about against contrary winds, and a most tremendous sea running "mountains high." I have known the winds to blow pretty hard on land sometimes, but here out on the open sea with nothing to break its force, it came with tenfold the power it has on land. Several times we were obliged to have every sail furled and even then the naked masts would bend like reeds.

On the 28th April it blew a most tremendous gale, with thunder and lightning and very heavy hail, but our vessel rode it out in gallant style, hardly shipping any water except in the evening through the fault of the man at the helm, who contrived to run the head of the vessel into an immense wave which overflowed the whole of the deck, set the water casks afloat, and sent a few hogsheads down the fore hatch which happened to be left open, frightening and drenching some of the steerage people. In the evening of this day I beheld a very beautiful meteor in the south-east. It was of a bright blue colour at first and after running a short course in the heavens gradually faded into red and then vanished. We constantly had the bird called the Stormy Petrel, by the sailors Mother Carey's Chicken, following in the wake of our ship; sometimes making short trips on the ocean skimming up and down the surface of the water, rising and sinking with the waves, and then returning back again to the stern of the vessel. This bird had a great resemblance to the martin and might easily be mistaken for that bird. Their manner of flying is very much the same. They are of a dark brown color, shaded with black on the back and wings, and a pure white on the rump. They follow in the wake of the vessel for the purpose of picking up any bits of bread or biscuit or any grease that may be thrown overboard. They are very easily caught with a piece of dark coloured string and a small hook baited with a piece of pork, or another way is merely to tie a small piece of wood at the end of a black thread and let it drag after the vessel. The birds come flying around the wood to see what it is doing: they fly against the thread and entangle their wings and you have only to pull them in, but they are harmless little creatures and no use after you get them, so that catching them would not do for me. According to the sailors they are the constant forerunners of a storm but we had them more or less the greater part of the voyage, and for two or three days

(*To be continued*).

NOTES.

DEER MOUSE DEVOURS HER YOUNG.—On September 8th, while hunting Batrachians, my friend Johnson and I turned a six foot log exposing two Jefferson's Salamanders and the nest of a White-footed Mouse.

The White-footed mother, leaving in haste, dragged two of her five pink, blind and hairless young a foot or so from the nest. We replaced them and put the log pack in position.

Passing that way two days later, we again turned the log and were surprised to find only three young mice, the other two having totally disappeared. We captured the mother and placed her with the nest and three young in a covered aquarium with plenty of food and water. The following morning the young were gone, without doubt devoured by the mother, who evidently considered them contaminated by the human touch.

Johnson, who has had considerable experience in pet raising states that ferret, white rat and domestic rabbit females will sometimes eat their young if the nest is disturbed even very slightly.

CLYDE L. PATCH, OTTAWA.

KILLING BIRDS HELPS THE ENEMY.—Killing birds that eat insects and weed seeds helps the enemy. The annual food loss in the United States from the ravages of insects on crops, according to the U. S. Department of Agriculture, exceeds $1,200,000,000. The loss in Canada is in proportion. Every careless person who kills a bird that is less injurious than it is valuable as an eater of weed seeds and insects is helping the enemy by killing our bird allies and by so doing is giving aid and comfort to the weeds and insects that reduce our food supply. Most of our birds are of this beneficial class and are really our allies. Robbing their nests is also an aid to the enemy. One can hardly go into the country without seeing boys and even men killing birds. Doubtless many of these persons would be surprised to know they were practical traitors and would gladly stop aiding the enemy if they knew it.

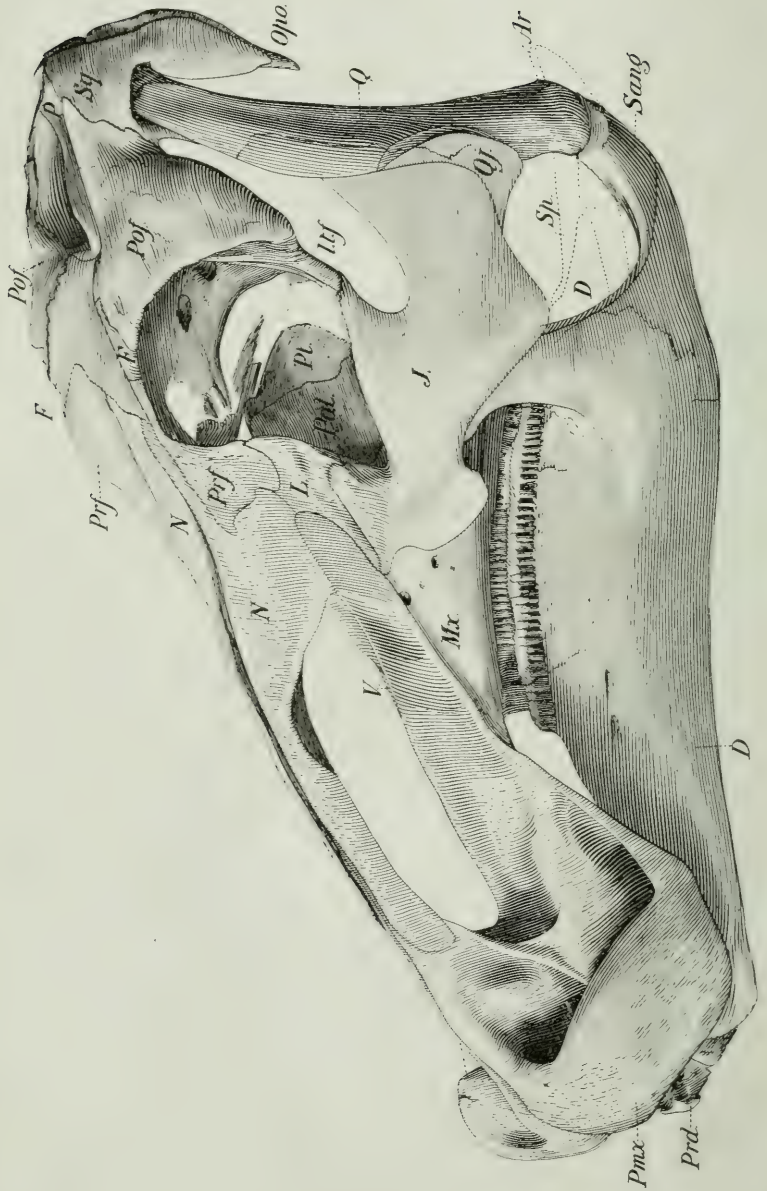
A large number of utterly fearless wild ducks are reported near Niagara. In one swamp along a brick highway where hundreds of autos pass daily and trolley cars run every 15 minutes, there have been 500 ducks for a month and they come up to this roadway to feed. Such a sight has not been seen in the region at least for years and the residents would pity any one who would molest the ducks. This is due to the Migratory Bird Law, and the recently arranged treaty between Canada and the United States.

The Buffalo Boy Scouts' Council has started a wild life club the members of which are pledged to do a good turn for the wild creatures of field and forest. A bronze button will be given the boys on qualifying for membership and, as they progress, silver and gold buttons will be awarded. When the plan is perfected it will be offered to the National Council with the hope that it will be adopted by the entire membership of the Boy Scouts, which exceeds 200,000. Some of the boys are giving illustrated talks in the schools on the value of wild life and the best means of protecting it.

The startling statement by no less an authority than Dr. C. K. Clarke, Superintendent of the Toronto General Hospital, that more than 12 per cent. of the patients admitted to the public wards of that institution have syphilis, is the feature of the eighth annual report of the Commission of Conservation just issued. These conditions, it is pointed out, are no doubt representative of those prevailing elsewhere in Canada where statistics are not yet available. The return of thousands of soldiers at the end of the war lends more than usual interest to this feature of the Commission's report. Other phases of the subject, including measures for controlling the menace, are discussed by Drs. J. J. Mackenzie, C. H. Hair, and Wm. Goldie, of the Faculty of Medicine, University of Toronto.

An address on The Production and Preservation of Food Supplies, by Dr. P. H. Bryce, gives tables showing the relative values of different foods. Results of experiments by the Commission at Port Dover, Ont., in utilizing fish waste in the manufacture of stock meal, oils and fertilizer, are set forth, while Drs. H. J. Wheeler and Frank T. Shutt make interesting contributions on the use of commercial fertilizers. In addition, a readable account is given of the varied activities of the Commission, including town planning, game preservation, water-powers, agriculture, mining and general publicity work.

The Comstock Printing Company of Ithaca, N.Y., recently published a most interesting volume of 438 pages entitled "The Life of Inland Waters." This book, the price of which is $3.00, is an elementary text of fresh-water biology for American Students. The authors are James G. Needham and J. T. Lloyd. This book is divided into seven chapters: I, Introduction; II, The Nature of Aquatic Environment; III, Types of Aquatic Environment; IV, Aquatic Organisms; V, Adjustment to Conditions of Aquatic Life; VI, Aquatic Societies; VII, Inland Water Culture. There are 244 text figures.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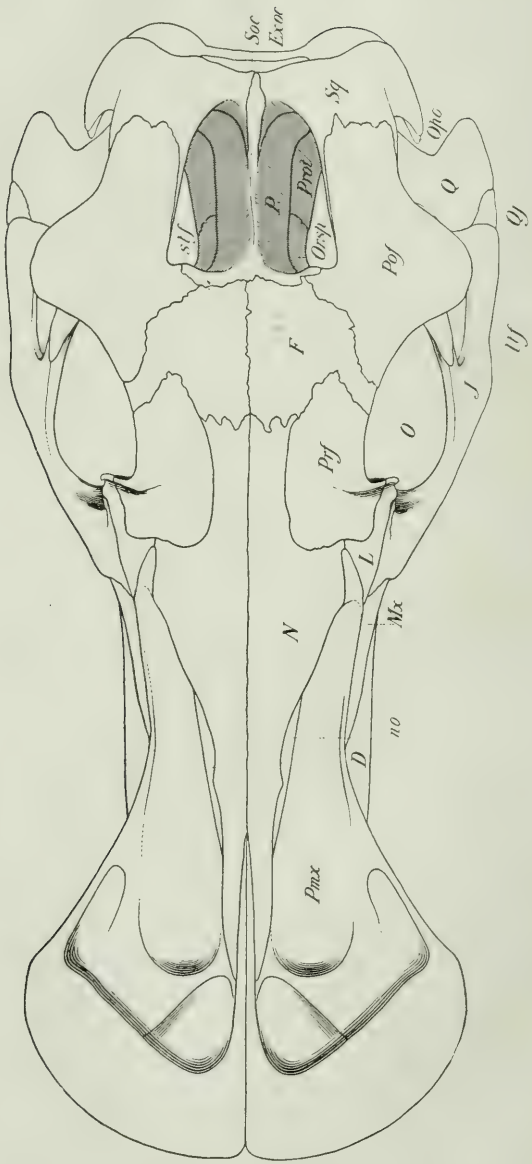
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A NEW GENUS AND SPECIES OF CRESTLESS HADROSAUR FROM THE EDMONTON FORMATION OF ALBERTA.*

By Lawrence M. Lambe, F.R.S.C.
Vertebrate Palæontologist, Geological Survey, Canada.

The Edmonton formation of the Cretaceous as developed on Red Deer river, Alberta, although not as rich in ceratopsian dinosaurs as the earlier Belly River beds, abounds in well preserved remains of hadrosaurs belonging to such recently described genera as *Saurolophus*, *Cheneosaurus* and *Hypacrosaurus*, forms which succeeded the crested *Stephanosaurus* and *Prosaurolophus* of Belly River times.

It has become evident that a non-crested hadrosaur of large size, represented by excellent and comprehensive material in the Geological Survey collections from the Edmonton formation of Red Deer river, belongs to a genus and species not hitherto described. The purpose of this paper is to give a preliminary description of this new form, with particular reference to the skull, reserving for the future a fuller account of its osteology which the excellent state of the material will permit.

This new genus is represented in the collections by the remains of two individuals of the same size including the skull in each case.

The first specimen (type) consists of the skull (figured in plate II) with the following important parts of the skeleton:—most of the vertebræ, in place, back to the sixth caudal; one hind limb lacking a few phalanges; one humerus; both pubic bones; one ischium; the greater part of the right ilium; and some ribs. Collection of 1912, Edmonton formation, Red Deer river, Alberta, from opposite the mouth of Three Hills creek, at 200 feet above the river level. Cat. No. 2288.

The second specimen (paratype) includes:—the skull, without the premaxillaries and the predentary; all the vertebræ with the exception of those behind the fifth caudal; and the fore and hind limbs lacking some of the bones of the feet. It is possible that the right

*Communicated with the permission of the Acting Deputy Minister of Mines.

ilium is not present. The bones of this individual are splendidly preserved and occurred scattered over a small area in a gray, clayey sandstone which is easily removed, leaving the surfaces in good condition. The elements composing the top of the skull behind are preserved together otherwise the skull is naturally disarticulated. Collection of 1916, Edmonton formation, Red Deer river, from 7 miles north-west of Morrin, in sec. 16, tp. 31, R. XXI, on the west side of the river, 90 feet above the level of the river. Cat. No. 2289.

The drawings for the figures accompanying this article are the work of Mr. Arthur Miles.

EDMONTOSAURUS REGALIS gen. et sp. nov.

Type of genus and species. Skull, with the skeleton largely represented. Cat. No. 2288. Discovered by L. Sternberg.

Paratype. A nearly complete skeleton, including the skull. Cat. No. 2289. Discovered by G. F. Sternberg.

Geological horizon and locality. Edmonton formation (upper Cretaceous), Red Deer river, Alberta, Canada.

Generic and specific characters. Skull moderately elongate, high and broad posteriorly, flat in the frontal region, laterally compressed behind a low, greatly expanded snout. Orbit large. A large, pocket-like recess developed within the postfrontal, leading from the orbit. Lateral temporal fossa restricted above. Palatine and pterygoid rising, at a high angle, inward. Ectopterygoid external to the maxillary and pterygoid, connecting the two. Mandible deep and strong, very slightly decurved in front. Teeth with a rounded apical outline in lateral aspect, keeled, and with smooth borders; in 48-49 vertical rows in the dentary, and 51-53 in the maxillary. Ischium long, bluntly pointed distally. Femur slightly longer than the tibia. Humerus nearly as long as the ulna. Cervical and dorsal vertebræ opisthocœlus, in a marked degree in the former. Dorsal spines of moderate size, increasing slightly in height backward in the series. Sacrum composed of eight vertebræ. Animal of robust build, about 40 feet long.

Edmontosaurus approaches most closely *Diclonius* Cope, one of the principal characters distinguishing the two being found in the shape of the skull which in *Edmontosaurus* is high and in *Diclonius* greatly depressed. The name *Diclonius* is here reserved for *D. mirabilis* Cope, from the Lance formation of Dakota, sometimes referred to as *Trachodon mirabilis* a genus and species insecurely established by Leidy in 1856, on a tooth from the Judith River beds of Montana. No characters can at present be assigned to Trachodon beyond those derived from the single mandibular tooth which constitutes the type.

Edmontosaurus rivalled in size its bulky contemporary *Hypacrosaurus*. It appears, however, not to have been as large as *Prosaurolo-*

phus, from the Belly River formation of Alberta, if the skull in the Hadrosauridæ* can be considered a criterion of the size of the animal as a whole.

In the paratype the canium proper (brain-case), the squamosals, postfrontals, prefrontals, lachrymals and nasals are preserved together, the other elements of the skull (with the exception of the premaxillaries, predentary, vomer, and right articular which were missing) were all found in a disarticulated state, free from each other and with practically no distortion. In the type skull (figure II) the premaxillaries are in position, the vomer is partially preserved, but the predentary is badly damaged. From the two specimens, therefore, we have full information relative to all the elements of the Edmontosaurus skull except the predentary and the vomer.

The paratype reveals the exact shape of the brain cavity and the position of the cranial nerves. In it are preserved without distortion the palatines, pterygoids, and ectopterygoids, three elements of which little has hitherto been known in the Hadrosauridæ.

In plates II and III, two aspects of the skull are given showing the relative position to each other of the elements seen from these particular viewpoints.

The skull of *Edmontosaurus* is large and massive, triangular in outline as seen from the side, high posteriorly, and narrowing down to the front. As viewed from above it is broad behind and in front, and greatly constricted behind the snout. Its posterior height is greater than its half-length. Its posterior breadth slightly exceeds the full lateral expansion of the snout, and is a little less than its half-length. The orbit is large, the quadrate long, and the great development of the premaxillary bones in front, to form the horizontally expanded snout, is remarkable. Viewing the skull from the side one is impressed by the depth and robustness of the mandible.

The principal bones of the skull with some of their main characteristics are briefly as follows:—

Frontal. Rather flat, of irregular shape, longer than broad, and entering narrowly into the formation of the orbital rim. Posteriorly it meets the parietal, externo-posteriorly the postfrontal, and anteriorly the nasal and prefrontal.

Postfrontal. Of considerable size, gibbously protrudent outward, somewhat triangular in superior aspect as well as when viewed from the side. Is in contact with the frontal, parietal, squamosal and jugal, extensively overlapping the squamosal. It forms the posterior curve of the orbital rim. A remarkable feature of this bone is the development within it of a deep, pocket-like recess leading back from the orbital cavity. Following the presence of this large recess the lateral

*The name Hadrosauridae proposed by Cope in 1869 (1871) has precedence to Trachodontidae used by Lydekker in 1888 and later by Marsh in 1890.

temporal fossa is restricted in its upper half-length, and the ascending process of the jugal is relegated to a position on the inner side of the pocket well-removed from the outer surface of the skull.

Prefrontal. Is in contact with the frontal, nasal and lachrymal, and forms the supero-anterior curve of the orbital rim. It overlaps the nasal to a considerable extent, and slightly overlaps the lachrymal. Its inner surface in advance of the orbital rim is excavated, leaving the bone thin.

Nasal. This bone is long and narrow, very slender in its anterior half-length, and relatively broad behind. It is in contact with the frontal, prefrontal, lachrymal, maxillary and premaxillary. Anteriorly the nasal pair are separated for about one-fourth of their length by the upper premaxillary limbs. The front termination of the bone is but slightly in advance of the anterior end of the narial opening. The contact with the maxillary is effected by a process running forward from the lachrymal contact, completing the enclosure of the posterior end of the narial opening within the nasal.

Lachrymal. Is wedge-shaped, twice as long as high, thickest behind, thin toward the front. Is in contact with the nasal, prefrontal, jugal, maxillary and premaxillary. Supero-anteriorly it is largely hidden beneath the end of the lower premaxillary limb. Its posterior border is protrudent and fully enters into the formation of the orbital rim. Above its sutural union with the jugal it lies external to and closely against the thin, elevated apex of the maxillary. In inner aspect the bone is seen to owe its posterior thickness to the development of an internal ridge which runs upward and slightly backward from the hinder end of the jugal contact and is prolonged thinly above between the nasal and the prefrontal. This ridge has a large perforation which marks the passage forward of the lachrymal canal.

Premaxillary. Consists of an anterior portion expanding outward from which are given off a long lower limb and a relatively short upper limb. The lower limb passes back over the maxillary and terminating narrowly overlaps the lachrymal and nasal. The two upper limbs separate the nasals anteriorly. The front border of the anterior expansion is recurved, roofing over an extensive cavity which opens backward on to an unevenly depressed floor. The bone does not anywhere attain any great thickness. The two premaxillaries together have an anterior breadth apparently little less than the maximum posterior breadth of the skull.

Jugal. Is long, thin, and plate-like, obtusely angulated in lateral outline below, and deeply emarginated above by the orbit and the lateral temporal fossa. It connects antero-superiorly with the lachrymal, anteriorly with the maxillary, posteriorly with the quadrato-jugal and the quadrate, and superiorly, behind its midlength, with the

postfrontal by means of a long, ascending process which passes on the inner side of the inner wall of the postfrontal pocket.

Quadrato-jugal. A thin, subtriangular plate, extensively overlapped by the jugal. Posteriorly it connects with the quadrate which is emarginated to receive it.

Quadrate. A transversely compressed, nearly upright bar from whose inner surface a large, thin flange is directed inward and forward. It is in contact antero-externally, below its midlength, with the quadrato-jugal, with the pterygoid internally by means of the flange, with the squamosal superiorly, and with the surangular and articular (mandibular cotylus) at its lower end. A spur from the squamosal descends on and is suturally united with the anterior border of the quadrate below its head.

Ectopterygoid. Connects the maxillary and pterygoid, lying for the most part external to both. Is longer than high, and is thin and overlapping except in a small inwardly thickened area which fits inward into the postero-maxillary notch suturally uniting the maxillary and pterygoid. It is broadest behind, where it flares thinly over the pterygoid, and extends narrowly forward in the postero-external, concave area of the maxillary. The upper and lower borders of the bone, where it begins to broaden posteriorly, fit into two grooves in the maxillary, one in the lower surface of the postero-maxillary process, the other curving downward round the posterior end of the maxillary ridge.

Maxillary. Connects suturally with the premaxillary, nasal, lachrymal, jugal, palatine, pterygoid and ectopterygoid bones. Is roughly triangular in lateral outline, highest at midlength, and thickest at about midlength below the large, rugose, external surface of attachment for the jugal. The inner face is rather flat in comparison with the varied relief of the outer one. The superior border slopes down from the apex to either end terminating in thin processes of which the anterior one is the larger. The anterior portion of the border is shallowly grooved, for a considerable distance in advance of the apical elevation, for the reception of the spur directed forward from the lower border of the nasal. The postero-superior border is in sutural contact with the lower edge of the palatine. The robust, rounded posterior end is clasped by the lowermost part of the pterygoid whose anterior border, in its upward course to reach the palatine, passes on the inner side of the postero-maxillary process. The ectopterygoid fills the emargination below this process, and extends narrowly and thinly forward for some distance in a depressed area of the external face below the postero-superior border. A less pronounced depression of the external face below the antero-superior border receives the ascending lower premaxillary limb. The teeth are in fifty-one to fifty-three

vertical rows occupying about seven-eighths of the total length of the bone.

Pterygoid. Is a thin bone of complicated shape in contact with the quadrate, palatine, maxillary, ectopterygoid, basisphenoid, parasphenoid and probably the vomer. It consists mainly in its upper part of an anterior and a posterior alar extension directed upward and forward, and upward and backward respectively. Both wings are thin and narrow rapidly upward. From either end of the base a short extending spur is developed. Internally the bone is strengthened by two large flanges, united above, and diverging downward to opposite ends of the base. At the centre of the superior border, between the wings, is an inwardly facing concave surface for attachment to the process of the basisphenoid. Sutural union with the quadrate is effected by the application of the external face of the posterior wing to the inner face of the flange of the quadrate, also the posterior basal spur fits into a narrow concavity at the base of the flange of the quadrate, further strengthening the union of the two elements. The anterior basal spur curves outward and forward on the posterior end of the maxillary, and a short distance higher up the postero-maxillary process passes externally back on the anterior border. Above the maxillary contact the front edge of the anterior wing for its full height is overlapped externally by the posterior border of the palatine. Above the anterior basal spur is a moderately large surface marking the external application of the posterior expansion of the ectopterygoid. The upper end of the anterior wing is apparently applied to the parasphenoid, and probably effects a junction with the hinder end of the vomer.

Palatine. Is irregularly triangular in lateral outline, is highest in front, and narrows downward and backward to the nearly straight base. It is plate-like, and is suturally united to the maxillary, jugal and pterygoid, and in position extends upward at a high angle inwardly above the postero-superior border of the maxillary. The anterior border is moderately thick and shallowly emarginated in its upper half to form the posterior border of the posterior nares. Antero-inferiorly is a roughened surface for contact with the jugal within the lower front angle of the orbit. Behind the jugal contact the palatine rests on the postero-superior border of the maxillary back to and slightly on to the posterior maxillary process. Thence forward and upward it outwardly overlaps the front border of the anterior wing of the pterygoid, rising to as great a height as that element. Infero-posteriorly it develops a thin internal process between which and the main termination of the bone the ascending anterior border of the pterygoid fits. Antero-superiorly it apparently has no connection with the vomer, the pterygoid intervening.

Vomer. This element appears to have been slender throughout and devoid of any considerable expansion. It is known in Edmontosaurus only from a small portion preserved in the type skull, plate II; the piece is over 125 mm. long and lies in the midline of the skull under the posterior half-length of the narial opening. It apparently connected in front with the maxillaries on the inner side of their anterior processes, and behind with the pterygoids on the interno-superior surface on the height of their anterior wings. It appears to have been narrow between the maxillary processes and to have had a slender termination in advance of them. Whether the vomer bifurcated behind and reached the pterygoid on either side in this manner, or united with the pair by a horizontal expansion has not been ascertained. It is estimated to have had a length in the figured skull of over 400 mm.

Angular. Is long, narrow, and thin, and is in sutural contact with the splenial, surangular, and dentary, running forward from a short distance in advance of the hinder end of the surangular, on the inner side of that bone, to a point on the dentary about in line with the midlength of the dental magazine. In lateral aspect it inclines slightly upward in one-third of its length posteriorly. Viewed from above it has a flattened sigmoid curve, suiting itself to the inner convexity of the surangular and the concavity of the lowermost part of the dentary. Superiorly, for its posterior half-length, it meets the lower border of the splenial.

Splenial. A moderately thin bone, shorter than the angular, applied anteriorly to the inner face of the dentary, and posteriorly to the inner face of the articular. Its lower border is in contact with the angular. It is deepest near the front where its superior border curves outwardly over the supero-internal termination of the dentary behind the dental magazine; farther forward it narrows rapidly to a point in contact with the dentary below the hindermost dental foramina. In the posterior two-thirds of its length it lessens but slightly in depth backward, and apparently terminated with a rounded lateral outline. It reaches farther back than the angular and is in contact with it for nearly the whole of the latter's half-length. Its inner face is moderately concave in a longitudinal direction.

Surangular. Is large and robust in comparison with the angular, splenial and articular, in conjunction with which it adds considerably to the length of the mandibular ramus, as the lowermost element of the mandible behind the dentary. It is through this bone, with a slight assistance from the articular, that the attachment of the mandible to the quadrate is effected. It articulates in front with the dentary, postero-superiorly with the articular, and laterally on the inner side with the angular. It consists of an oblong main portion, longer than broad, from which is given off antero-exteriorly a thin, ascending

process. Anteriorly it overlaps the thin, lower posterior termination of the dentary. Postero-internally the main portion of the bone extends thinly backward, facing upward and inward beneath the articular. Toward the inner border a thin flange, rising from the upper surface passes forward external to the articular. The mandibular cotylus occupies the postero-external angle of the main portion of the bone.

Articular. This element, as yet not fully known, is higher than broad, thinnest below in its more posterior part, and extends forward as a moderately thin bone wedged in between the surangular and the outer face of the splenial. Below it is supported by the surangular. Supero-externally it supplies a surface as its contribution to the mandibular cotylus. The bone is preserved, in part, both in the type skull, and in the disarticulated skull, Cat. No. 2289.

Dentary. Is large, with three-eighths of its length in front edentulous, deeply excavated posteriorly by the mandibular fossa, and with the dental magazine occupying nearly one-half the length of the bone. The coronoid process is robust and placed far back. The dentary attains its greatest breadth across this process. For the full length of the magazine it is deep and moderately thick. The edentulous part is comparatively thin with a gradually lessening depth forward, is longitudinally concave internally, and curves abruptly inward in front, with a lowering of the superior border, to meet the opposite dentary in a ligamentous connection behind the predentary. The mandibular fossa excavates the coronoid process behind, and internally is continuous with the Meckelian groove which lessens in depth in its forward course near the lower border of the bone, and disappears in advance of a point in line with the front end of the magazine. Behind the magazine the dentary ends in a laterally compressed, pointed process, internal to the mandibular fossa. This process is covered on its inner face, and embraced above, by the anterior end of the splenial. Posteriorly, beneath the Meckelian groove, is a narrow surface marking the internal application of the angular as far forward as a point nearly beneath the midlength of the magazine. Posteriorly below the dentary is transversely broad, thin and obtusely pointed at its termination, underlapping the surangular so that the floor of the mandibular fossa is continuous with the upper front surface of the surangular. The narrow symphysial surface is deeply grooved from front to back. The dental foramina, corresponding in number to the vertical series of teeth, are conspicuous internally below the magazine. At the anterior end externally is a rather large foramen behind which are six or seven smaller ones at irregular intervals back to the front of the magazine. Still farther back are a few other foramina in the outer face of the bone.

In the dentary there are forty-eight or forty-nine vertical series of teeth with four or five and sometimes the stump of a sixth in each series. The individual teeth are largest at the midlength of the magazine and decrease in size toward either end of it, the posterior ones being considerably shorter but only slightly narrower than those in front. The inner enamelled tooth-surfaces, in lateral aspect, are nearly lozenge-shaped in outline, with the longer diameter vertical, and fit closely together quincuncially in a mosaic which is almost half covered from below by the thin alveolar wall. There are about 230 teeth in each dentary, this being many less than the number (406) ascribed to *Diclonius mirabilis* by Cope in his description of that species in 1883.

MEASUREMENTS OF THE SKULL OF EDMONTOSAURUS.

	Mm.
Length of type skull measured in a straight line from the posterior edge of the opisthotic to the middle of the anterior premaxillary border	1114
Horizontal length of same from anterior premaxillary border to a point vertically below the edge of the opisthotic (paroccipital)	1066
Length of quadrate	420
Breadth of skull (paratype) between the external convexity of the postfrontals behind the orbit. (The size of the skull in the type and paratype is about the same)	428
Length of mandibular ramus of paratype without predentary	908
Length of dentary of paratype	780

EXPLANATION OF PLATES.

Plate II—Left lateral aspect of the type skull of *Edmontosaurus regalis*, one-seventh natural size.

Plate III—Superior aspect of skull of *Edmontosaurus regalis*. one-seventh natural size. This view is taken from above with the skull in the position in which it is shown in plate II, viz., with the line of the teeth practically horizontal.

ABBREVIATIONS:—*Ar*, articular; *D*, dentary; *Ex. oc.*, exoccipital; *F*, frontal; *J*, jugal; *L*, lachrymal; *l.t.f.*, lateral temporal fenestra; *Mx*, maxillary; *N*, nasal; *no*, nasal opening; *O*, orbit; *Opo*, opisthotic; *Orsp*, orbitosphenoid (alisphenoid); *P*, parietal; *Pof*, postfrontal; *Pal*, palatine; *Pmx*, premaxillary; *Prd*, predentary; *Prf*, prefrontal; *Prot*, proötic; *Pt*, pterygoid; *Q*, quadrate; *Qj* quadrato-jugal; *Sang*, surangular; *Soc*, supraoccipital; *Sp*, splenial; *Sq*, squamosal; *s.t.f.*, supratempotal fenestra; *V*, vomer.

THE RED-TAILED HAWK IN MANITOBA.

By NORMAN CRIDDLE, TREESBANK, MAN.

The Red-tail is one of the most beautiful of our Canadian hawks and in Manitoba among the semi-wooded areas, is still one of the commonest. That it is still numerous is due to the fact that its more secluded haunts have enabled it to escape much of the persecution to which the misinformed public have subjected its close allies, the Rough-legged and Swainson's hawks.

The favourite nesting sites of the Red-tail are along the wooded borders of rivers and streams, though the bird is by no means confined to such places, but is found breeding over much of the semi-wooded portions of the province. In general habits this hawk does not differ greatly from Swainson's hawk, to which reference was made by the writer in a previous volume of THE OTTAWA NATURALIST. It is, however, two or three weeks earlier in arriving from the South in spring time, commences to build earlier, and is far more a bird of woodlands than either Swainson's or the Rough-legged hawk. Moreover, it has never been found nesting upon the ground and rarely in isolated trees.

The nest of this species is composed of large and small twigs, well lined with the inner bark of aspen poplar, being a somewhat bulky structure. There seems a general tendency, on the bird's part, to seek a new nesting site each year. This, however, is not always done, some birds being known to occupy the same nest for two or more years in succession. The same nests have also been rebuilt and used after one or more years interval. There is reason to suspect that old nests would be much more frequently utilised were it not for the fact that the Western Horned owl habitually takes possession of these before the hawks return. Thus, the nests available for the latter depend upon the number of horned owls present in the vicinity.

The number of eggs laid by each female varies somewhat and seems to depend, at least to some extent, upon the food supply. In 1917, the six nests under observation close to the writer's home, contained but two eggs each and in only one of the six did the parents succeed in rearing more than one young though both were hatched in every instance. The first nest was discovered on May 6, containing two eggs. Other nests with eggs were located as late as June 14. It is difficult to account for the mortality among the young, though it is noteworthy that the deaths occurred while they were still quite small, and that the latest hatched, and consequently smallest, was invariably the one to die. Dead examples presented no indication of violence but seemed to show that, in all probability, death was due to

starvation, the lack of food being due in its turn to a scarcity of ground squirrels (gophers) and to the unusual number of hawks nesting in the district.

The curious habit of the old birds in gathering a green leafy bough and placing it in the nest, characteristic of Swainson's hawk also, is very marked in the Red-tail, a fresh bough being gathered at least once daily during the time when the young are small. There has been some doubt hitherto as to the cause of this habit, but by observing the nestlings I am led to believe that the bough acts as a sun shade, as the young have been seen to repeatedly pull the bough over themselves and crouch beneath it. Doubtless it also acts as a shield and hides the young from their enemies. The leaves are also occasionally eaten.

As the young develop they acquire a good deal of boldness and defend themselves with both beak and claws. They have a habit of closely watching the intruder backing up meanwhile at the approach of a hand; then suddenly they leap forward with wings outstretched and it requires a rapid movement to escape their onslaught. The old birds make no efforts to defend their young, but fly high overhead uttering loud cries which are, at times, answered in a shriller key by the young beneath. In the fall these birds may be seen resting upon trees and telephone posts, looking very un-Red-tailed in appearance and superficially very like the young of Swainson's hawk. Towards the middle of October they make their way steadily southward and by the end of the month have practically all passed beyond our borders.

The food habits of hawks have been discussed on many occasions and the examination of stomachs by Fisher and others in the United States shows that all our large buzzard-like hawks, such as the Red-tail, Rough-legged and Swainson's hawks, are extremely useful. In discussing these from the standpoint of the prairie farmers, however, we have to take into consideration the fact that the prairie provinces are largely grain producing. Secondly, that they are infested by several species of ground squirrel which are quite unknown in eastern Canada and which take heavy toll from the grain fields. Thus our problems in regard to hawks are quite unlike those of the east and it seems a mistake to unite these in an article of this sort.

As the Red-tailed hawk is more an inhabitant of woodlands than the other species mentioned above it naturally follows that it is not so much a hunter of the plains, hence the prairie ground squirrels do not form so large a proportion of its food. They are, however, taken in quite large numbers and are supplemented by wood-loving kinds such as Franklin's ground squirrel, the common red squirrel and by mice. The food habits are also much more difficult to ascertain owing to the thorough manner in which the parents clean up the nest and to

their habit of not leaving food nearby. Thus, unless one kills the birds and examines their stomachs, it is necessary to rely almost wholly upon the disgorged pellets overlooked by the parents, which unfortunately are practically absent during the early stages of the existence of the young. Details of pellets examined in 1917 are:

July 2—14 pellets collected beneath the nest of a pair of young; two made up of feathers and weed seeds from one or more vesper sparrows; four containing hair of voles and mice and odd bones of these rodents; the remaining pellets containing ground squirrel hair and a few bones chiefly of the striped species, *Cetillus tridecemlineata;* a few aspen leaves were also present.

July 10—Six pellets beneath the nest of a single nestling, chiefly made up of vole hair and with three sets of teeth of these animals, also bones and feathers of a young crow. Pellets from another nest taken on the same day, five in all, showed a few bird feathers, parts of two voles, much hair of the same rodents, ground squirrel hair and three tail tips of Franklin's ground squirrel.

July 31—Three pellets gathered containing hair and bones of ground squirrels, the former of *C. richardsoni* and *franklinii.* Odd bones and a tail of the last species were also located upon the ground. The young hawk had left this nest about ten days. Another nest from which the young had departed was examined on October 5; it contained broken pellets consisting of ground squirrel hair and bones.

These studies, as was mentioned above, relate to a single season's observations. Similar studies, covering a number of years show little variation in the kind of food consumed. The situation of the hunting grounds naturally influences the results inasmuch as these are apt to be frequented by a greater number of animals of one species in one place and another kind elsewhere. A shortage of some particular animal, such as ground squirrels, will have to be made up by the collecting of some other such as mice or birds, all of which have to be taken into consideration before we can arrive at a true knowledge of any hawk's food habits.

With regard to the relation of Red-tailed hawks to poultry, I have yet to learn of a single instance of these hawks having attacked poultry of any kind, though it is not at all an uncommon event to find them nesting within a few hundred yards of barnyards and poultry runs. Such is the evidence brought out by this investigation. The destruction of a few sparrows may be used against the hawks. The killing of a vastly greater number of noxious rodents leaves a large balance in the bird's favour. We can, therefore, come to but one conclusion, namely, that it is not only a friend to the farmer but also a useful ally as a conserver of our food supply.

WAS THE LOWER CAMBRIAN TRILOBITE SUPREME?*

BY LANCASTER D. BURLING.

A new species of Lower Cambrian trilobite, *Paedeumias robsonensis*, has recently been described† from a single specimen which is unique among the thousands of specimens of known trilobites in its imperfection. The reason for the extraordinary perfection of the tests of previously discovered trilobites has apparently escaped critical observation though the late development of the ability to roll up into a ball has been appealed to as indicating that the trilobite was the supreme arbiter of the early Cambrian seas and needed no such protection. He has recently been deposed from this position, however, at least for the Middle Cambrian, and his title conferred upon *Sidneyia inexpectans* Walcott‡, a Merostome-like crustacean which has been described as armed with a truly formidable set of chelate appendages or claws (see figure 2). In the Lower Cambrian, however, nothing has hitherto been discovered that would dispute the claim of the trilobite to be the largest inhabitant of the seas, and the specimen of *Paedeumias* above mentioned is as large or larger than any other fossil so far discovered in the lower Cambrian rocks of the Northwestern Cordillera. It is further noteworthy in having the greatest number of ribs (44) ever discovered in a trilobite. Fifteen of these are of large size and their long spines almost completely encircle the remaining 29 (or more, the end is broken off) which are smaller and nearly equal in size.

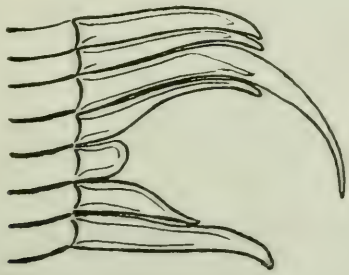

Fig. 1—Paedeumias robsonensis Burling. Outline of right half of the first seven ribs, showing extent of injury. As can be seen by the photograph reproduced on plate I, Vol. XXX, opp. p. 53, the left half of these ribs is normal, with the exception that the fifth is slightly shorter than the fourth and sixth. The enlargement of the third rib is characteristic of the family to which the species belong. Three-fourths natural size.

*Published by permission of the Deputy Minister of Mines.
†Ottawa Naturalist, vol. 30, 1916, pp. 53-58, pl. I.
‡Nat. Geog. Mag., vol. 22, 1911, p. 511.

How does it happen that this trilobite has lost the ends of two of his largest ribs and that a third, which lies between them, has been cut off close to the central part of his body? And what light do we receive from the fact that the broken ends of these ribs have started to heal up and show fairly well developed terminations? (See figure 1).

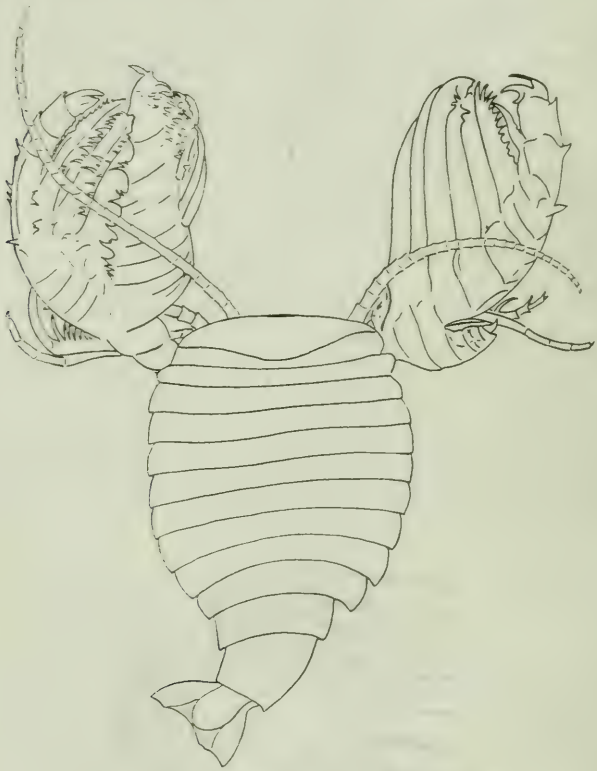

Fig. 2—Restoration of Sidneyia inexpectans Walcott. Made by grouping together a body and two claws found within the limits of the same Middle Cambrian faunule on the slopes of Mt. Field, British Columbia. The two claws are probably both rights or both lefts, one (left in the figure) showing one side, with the "thumb" in place, the other showing the reverse side of a claw probably belonging to the same side of the animal, with the "thumb" broken away. The individual portions after Walcott. One-half natural size.

If we assume that the trilobite lost this portion of his anatomy while he was a very small animal, why was he so long about fixing up his lost ribs? Crustacea now have the power of rebuilding lost parts of their body, and this primitive crab has proven by his ability to heal

the broken ends of his ribs that Cambrian trilobites possessed the same ability.* Therefore it must have happened very recently in his life history or all traces of the accident would have been removed. But if it happened such a short while ago the chunk must have been removed by a foe more voracious if not actually larger than himself and we are apparently justified in assuming the presence in the Lower Cambrian seas of animals capable of inflicting such an injury. The only other explanation is that he became pinned beneath material dropping from an overhanging ledge, and an apparent crowding and dwarfing of the ribs immediately adjacent to the cut lends a degree of plausibility to the idea that they were bruised at the same time.

So far as we can judge from the present appearance of the edges of the wound it was comparatively clean cut, and made by a jaw capable of cutting not only at the extreme tip but for some distance along each side, for the ribs next in front and back of the one in the middle are cut off diagonally. A *Sidneyia*-like crustacean (see figure 2) could hardly be expected to clip so symmetrical and clean a section. If we were to hazard a guess we would say that the most reasonable conclusion would be that it was the work of a fish. These, the earliest known vertebrates, are not known from rocks earlier than those of the immediately overlying system, the Ordovician, but ancient rocks are growing daily more responsive and such a guess is far within the range of probability.

PROGRAMME OF WINTER LECTURES, 1917-1918.

December 18, 1917—"Two Years in N. E. Greenland." Mr. Frits Johansen, Naturalist on the "Danmark" Expedition, 1906-1908.

January 8, 1918—"Mobilizing the Forests for War and Peace." Mr. Robson Black, Secretary of the Canadian Forestry Association.

January 22, 1918—"Diseases of Domestic Animals." Dr. S. Hadwen, Pathologist, Dept. of Agriculture, Ottawa.

February 5, 1918—"Local Snakes, Frogs and Salamanders: Their Relation to Agriculture." Mr. Clyde L. Patch, Victoria Memorial Museum, Ottawa.

February 19, 1918—"Fishing and the Canadian Fisheries, with Special Reference to the Atlantic Coast." Mr. W. A. Found, Superintendent of Fisheries, Ottawa.

March 5, 1918—"The Fur Seals." Mr. James M. Macoun, C.M.G., Victoria Memorial Museum, Ottawa.

March 19, 1918—"Naturalists and Tropical Diseases." Major J. L. Todd, Ottawa, lately Professor of Parasitology, McGill University. At the conclusion of this lecture the ANNUAL MEETING of the Club will be held.

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*Perhaps the quickness of this recovery in these early forms is the reason for the perfection of the forms which have hitherto been discovered.

WHY THE LEAVES CHANGE THEIR COLOR.

The change in the color of leaves in autumn is not, as many people suppose, due to the action of frost, but is a preparation for winter. All during the spring and summer the leaves have served as factories, where the foods necessary for the trees' growth have been manufactured. Ths food making takes place in numberless tiny cells of the leaf and is carried on by small green bodies which give the leaf its color. These chlorophyll bodies, as they are known, make the food of the tree by combining carbon taken from the carbonic acid gas of the air with hydrogen, oxygen, and various minerals supplied by the water which the roots gather. In the fall when the cool weather causes a slowing down of the vital processes, the work of the leaves comes to an end. The machinery of the leaf factory is dismantled, so to speak, the chlorophyll is broken up into the various substances of which it is composed, and whatever food there is on hand is sent to the body of the tree to be stored up for use in the spring. All that remains in the cell cavities of the leaf is a watery substance in which a few oil globules and crystals, and a small number of yellow, strongly refractive bodies can be seen. These give the leaves the yellow coloring so familiar in autumnal foliage.

It often happens, however, that there is more sugar in the leaf that can be readily transferred back to the tree. When this is the case the chemical combination with the other substances produces many-colored tints varying from the brilliant red of the dogwood to the more austere red-browns of the oak. In coniferous trees, which do not lose their foliage in the fall, the green coloring matter takes on a slightly brownish tinge, which, however, gives way to the lighter color in the spring.

While the color of the leaf is changing, other preparations are being made. At the point where the stem of the leaf is attached to the tree, a specal layer of cells develops which gradually sever the tissues which support the leaf. At the same time Nature heals the cut, so that when the leaf is finally blown off by the wind or falls from its own weight, the place where it grew on the twig is marked by a scar.

Although the food which has been prepared in the cell cavities is sent back to the tree, the mineral substances with which the walls of the cells have become impregnated during the summer months are retained. Accordingly, when the leaves fall they contain relatively large amounts of valuable elements, such as nitrogen and phosphorus which were originally a part of the soil. The decomposition of the leaves results in enriching the top layers of the soil by returning these elements and by the accumulaton of humus. That is why the mellow black earth from the forest floor is so fertile.—(From the Forest Service, U. S. Dep. Agric.)

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NOTES ON THE WINTER BIRDS OF THE OKANAGAN VALLEY.

By J. A. Munro.

In comparison with eastern Canada, the winter season of the Okanagan Valley is mild, with a lighter snowfall and a greater number of clear sunny days. In normal years the first cold weather comes towards the end of November. Between November and the first of March there are usually three or four cold snaps, when the temperature drops to ten or fifteen below zero. By the end of February the snow has melted and warm sunny days are the rule.

During the severe winter of 1915-16, zero weather lasted almost continuously from January 9th until February 4th. There was an unusually large amount of snow and Okanagan Lake was frozen over. The lowest temperature at Okanagan Landing was 24° below zero.

Along the lake shore and in the river bottoms various wild fruits, such as snowberry and rose hips insure an abundant food supply. The fruit of the Black Haw (*Crataegus douglasi*) usually dries on the bushes and is greedily eaten by Bohemian Waxwings and Pine Grosbeaks. Introduced weeds are well represented along roadsides and on waste ground. *Amaranthus retroflexus*, *Chenopodium album* and *Melilotus alba* are the commonest and the seeds form the staple diet of Sparrows, Redpolls and Juncoes.

The following notes cover the period between 1911 and 1917, inclusive.

Western Grebe—*Æchmophorus occidentalis.*

A few winter on Okanagan Lake.

Holboell's Grebe—*Colymbus holboellii.*

A few winter on Okanagan Lake. Both this species and the former, die in large numbers every fall. Specimens examined were in an emaciated condition and contained several species of parasitic nematodes. In several cases a mass of wire-like parasites, clustered between the leg muscles and the skin, caused the knee joints to swell to twice the normal size. A segmented tape-worm was present in several specimens.

HORNED GREBE—*Colymbus auritus.*

Winters commonly on Okanagan Lake.

RED-BILLED GREBE—*Podilymbus podiceps.*

A few winter on Okanagan Lake.

LOON—*Gavia imber.*

A few winter on Okanagan Lake.

RED-THROATED LOON—*Gavia stellata.*

A juvenal female picked up on the shore of Okanagan Lake, November 22nd, 1915. Small Loons observed on several occasions were probably of this species.

HERRING GULL—*Larus argentatus.*

Common winter resident.

CALIFORNIA GULL—*Larus californicus.*

Not as common as the former.

MERGANSERS—*Mergus americanus.*

Common resident.

RED-BREASTED MERGANSER—*Mergus serrator.*

Regular winter resident.

MALLARD—*Anas platyrhynchos.*

The bulk of the surface feeding ducks, leave in November, when the small lakes and sloughs freeze over. A few remain as long as there are open stretches of water in the streams but become quite poor. Frequently mixed flocks of Mallard, Pintail, etc., are seen picking up the weeds that have become dislodged by the wind and have drifted on to the ice on the shore of the lake.

GADWALL—*Chaulelasmus streperus.*

No winter records since January 1912.

BALDPATE—*Mareca americana.*

A few remain all winter and live parasitically on the Redheads, snatching the weeds from their bills as they rise to the surface. They are in constant motion, when feeding, dashing at every duck that rises near them.

GREEN-WINGED TEAL—*Nettion carolinense.*

A few winter.

PINTAIL—*Dafila acuta.*

A few winter.

REDHEAD—*Marila americana.*

The commonest duck on Okanagan Lake in winter. Late in January, when their feeding grounds at the south end of the lake become frozen, they congregate in enormous flocks in the vicinity of Okanagan Landing. The prevailing winds are southerly and serve to keep the shallow water here free of ice. Several specimens of pond-weeds (*Potamogeton*) afford an abundant food supply. By February 15, the flocks have reached their maximum and number several thousand. They remain in these large bands until March, when they

move north. A small number remain and breed. Males outnumber females in the proportion of 15 to 1. Courtship commences about the last week in February. This is interesting in view of the fact that they are one of the last ducks to breed. I have found fresh eggs late in June and half grown young in September.

The following is from my note book:

February 28, 1916—Large flocks of Redhead close to shore. feeding and courting. Some were mated and copulating. The drake swims swiftly to the duck, and appears to seize her by the neck with his bill. The duck is at once submerged and remains so until the drake leaves her. Five drakes seen to follow a duck and surround her in a circle. They stretch their necks straight up, the front part slightly elevated, showing the black breast, the crown feathers erected. Sometimes they uttered a coarse quack before relaxing.

February 29, 1916—Large flocks feeding close to the beach. Those nearest to the shore were dipping like mallards. They bring the pondweed to the surface and after shaking it several times, swallow in a series of gulps. The mating call is a coarse quack; the wheezy cat-like cry is made when feeding. I have been unable to discover if it is made by both sexes.

CANVAS-BACK—*Marila valisneria.*

Regular winter resident, not common.

SCAMP DUCK—*Marila marila.*

Abundant winter resident.

LESSER SCAMP DUCK—*Marila affinis.*

Regular winter resident; not as common as the former.

RING-NECKED DUCK—*Marila collaris.*

Regular winter resident; unusually abundant during the winter of 1915-16.

GOLDEN-EYE—*Clangula clangula americana.*

Common winter resident.

BARROW'S GOLDEN-EYE—*Clangula islandica.*

Scarce winter resident. Breeds commonly here and leaves in October or earlier. The drakes leave soon after the eggs are laid in May. Most of the winter records are for juvenals.

BUFFLE-HEAD—*Charitonetta albeola.*

Common resident. The drakes disappear soon after the eggs are laid and are not seen again until October.

OLOR. (Sp.?)

A small flock of swans winter regularly.

COOT—*Fulica americana.*

Abundant resident. They gather in large flocks in the late fall and are loth to move south, even when their feeding grounds freeze over, in the smaller lakes. During cold winters, hundreds remain on

the ice and die of starvation or fall victims to the coyotes and bald eagles.

WILSON'S SNIPE—*Gallinago delicata.*

A few remain all winter in the vicinity of springs or along the rapid streams that remain open during the cold weather.

KILLDEER—*Oxyechus vociferus.*

One record, December 9, 1912.

RICHARDSON'S GROUSE—*Dendragopus obscurus richardsoni.*

Resident.

FRANKLIN'S GROUSE—*Canachites franklini.*

Resident in the Murray pine and spruce forests.

CANADA RUFFED GROUSE—*Bonąsa umbellus togata.*

Resident. The breeding race appears to be typical *togata.* During October there is usually a local migration from the higher mountains and a much grayer bird appears, which is probably closer to *umbelloides.*

WHITE-TAILED PTARMIGAN—*Lagopus leucurus leucurus.*

Breeds above timber line in southern Okanagan. Taken in winter on the Silver Star mountain, near Vernon, by Allan Brooks.

COLUMBIAN SHARP-TAILED GROUSE—*Pedioecetes phasianellus campestris.*

Resident. Grouse of all species have become very scarce during the past two years and a close season for all of British Columbia east of the summit of the Cascade mountains was declared in 1917. The scarcity is accounted for by the ravages of an intestinal parasite coupled with two severe winters, cold wet springs and the increase of coyotes and skunks.

WESTERN MOURNING DOVE—*Zenaidura macroura marginella.*

One winter record, January 27, 1916.

MARSH HAWK—*Circus hudsonius.*

Resident.

SHARP-SHINNED HAWK—*Accipiter velox.*

Two winter records, January 24, 1913; January 3, 1917.

GOSHAWK—*Astus atricapillus atricapillus.*

Common Resident.

ROUGH-LEGGED HAWK—*Archibuteo lagopus sancti-johannis.*

Winter resident, never common.

GOLDEN EAGLE—*Aquila chrysaëtos.*

Resident. Not common.

NORTHERN BALD EAGLE—*Haliætus leucocephalus alascanus.*

Common resident.

DUCK HAWK—*Falco peregrinus anatum.*

Resident; not common.

PIGEON HAWK—*Falco columbarius columbarius.*

Resident; not common.

BLACK PIGEON HAWK—*Falco columbarius sucklei.*
One record, February 7, 1914.
DESERT SPARROW HAWK—*Falco sparverius phalæna.*
One winter record, January 22, 1917.
LONG-EARED OWL—*Asio wilsonianus.*
Common resident.
SHORT-EARED OWL—*Asio flammeus.*
Common winter resident; a few remain to breed.
GREAT GREY OWL—*Scoptiaptex nebulosa nebulosa.*
Scarce winter resident.
RICHARDSON'S OWL—*Cryptoglaux funerea richardsoni*
Scarce winter resident.
SAW-WHET OWL—*Cryptoglaux acadica acadica.*
Resident; not common.
MACFARLANE'S SCREECH OWL—*Otus asio macfarlanei.*
Common resident.
GREAT HORNED OWL—*Bubo virginianus.*
The breeding form is consistently dark with the heavily mottled feet of "*saturatus.*" In the winter a much lighter, more ruescent form occurs. I have never taken anything approaching *subarcticus.*
SNOWY OWL—*Nyctia nyctia.*
Winter resident; not common. During the winter of 1916-17, when the big migration of this species occurred on the Pacific coast, they were slightly more common here.
HAWK OWL—*Surnia ulula caparoch.*
Winter resident; not common. Breeds in the high mountains in southern Okanagan.
PYGMY OWL—*Glaucidium gnoma gnoma.*
Common resident.
BELTED KINGFISHER—*Ceryle alcyon.*
A few generally winter.
ROCKY MOUNTAIN HAIRY WOODPECKER—*Dryobates villosus monticola.* Common resident.
BATCHELDER'S WOODPECKER—*Dryobates pubescens homorus.*
Common resident.
WHITE-HEADED WOODPECKER—*Xenopicus albolarvatus.*
Two records, December 20, 1911; January 24, 1914.
ARCTIC THREE-TOED WOODPECKER—*Picoides arcticus.*
Resident in the Canadian zones.
ALASKA THREE-TOED WOODPECKER—*Picoides americanus fasciatus.*
Resident in the Canadian zone.
NORTHERN PILEATED WOODPECKER—*Phloeotomus pileatus abieticola.*
Common resident.
RED-SHAFTED FLICKS—*Colaptes cafer collaris.*
A few always winter.

PALLID HORNED LARK—*Otocoris alpestris arcticola.*

Breeds above timber line. Arrives in the valleys in large flocks early in September. Small flocks remain through the winter, but the majority of the birds go farther south in late October.

MAGPIE—*Pica pica hudsonia.*

Abundant resident.

BLACK-HEADED JAY—*Cyanocitta stelleri annectens.*

Common resident.

ROCKY MOUNTAIN JAY—*Perisoreus canadensis capitalis.*

Resident in the Canadian zone.

NORTHERN RAVEN—*Corvus corax principalis.*

Resident in the Canadian zone.

WESTERN CROW—*Corvus brachyrhynchos hesperis.*

Abundant resident. The bulk of the crows spend both winter and summer in the brushy river bottoms in the vicinity of cleared land.

CLARKE'S NUTCRACKER—*Nucifraga columbiana.*

Resident; sometimes common. During the fall and winter they feed almost exclusively on the seeds of the yellow pine (*Pinus ponderosa*). When the seed crop is light they leave the district entirely. Very few were seen in the Okanagan from July, 1915 until August, 1917. They are plentiful again this winter (1917-18).

NORTHWESTERN RED-WING—*Agelaius phoeniceus caurinus*

Abundant resident.

WESTERN MEADOWLARK—*Sturnella neglecta.*

Abundant resident. During cold weather they frequent straw stacks, burrowing into the loose straw for warmth.

BREWER'S BLACKBIRD—*Euphagus cyanocephalus.*

In 1912-13, this species wintered in large numbers in the city of Kelowna, feeding on street refuse. I have no winter records north of this.

WESTERN EVENING GROSBEAK—*Hesperiphona vespertina montana.*

Winter resident, some years abundant. They are usually more common in the cities where the seeds of the box elder are the attraction. When the supply of seeds is exhausted, they move out into the country, feeding on the choke cherry kernels and the small black haws (*Crataegus douglasi*) that have dried on the bushes during the hot summer. In the summer of 1916 they remained in the city of Vernon as late as June 5, and were then feeding on green box elder seeds. A few pairs undoubtedly breed in the mountains close to here, as I have taken juvenals in August.

ROCKY MOUNTAIN PINE GROSBEAK—*Pinicola enucleator leucura.*

Winter resident, sometimes abundant. Breeds in the high mountains near timber line in the southern Okanagan. Winter birds are probably from the north. They gather in large flocks in the orchards, tearing the seeds out of the frozen apples. The pulp that

falls to the ground is generally eaten by Bohemian Waxwings. Frequently they feed together.

CASSIN'S PURPLE FINCH—*Carpodacus cassini.*

Three winter records.

CROSSBILL—*Loxia curvirostra minor.*

Common resident; erratic in their appearance. I have shot females in February and in August that were undoubtedly breeding.

GRAY-CROWNED ROSY FINCH—*Leucosticte tephrocotis tephrocotis.*

HEPBURN'S ROSY FINCH—*Leucosticte tephrocotis littoralis.*

Both forms breed above timber line in the Similkameen district and in the Gold Range. Large flocks come into the valley during December and January. *Littoralis* is much the more common. *Tephrocotis* occurs in the flocks in the proportion of one to twenty or thirty. Specimens that are intermediate are common. I have frequently seen flocks of three or four hundred suddenly appear and swarm over a bare place on the open range in search of gravel. When disturbed they often circle several times, their undulating flight and soft voices suggesting the shore lark. If birds have been shot out of the flock, the remainder will come back time after time, fluttering to the ground, close to the dead birds. On one occasion, a flock, disturbed from an alfalfa field, flew up, in an ever narrowing spiral, for several hundred feet and then closed into a compact flock and flew straight away.

HOARY REDPOLL—*Acanthis hornemanni exilipes.*

Rare. One was taken in a flock of *linaria* on February 24, 1912, and two specimens taken in December, 1916.

REDPOLL—*Acanthis linaria linaria.*

Abundant winter resident. The earliest date seen, November 9, and the latest recorded in the spring, March 30.

PALE GOLDFINCH—*Astragalinus tristis pallidus.*

Common resident.

PINE SISKIN—*Spinus pinus.*

Abundant resident.

SNOW BUNTING.

Abundant winter resident. The earliest record October 15, and the latest February 14.

HARRIS SPARROW—*Zonotrichia querula.*

One winter record, December 2, 1911.

GAMBEL'S SPARROW—*Zonotrichia leucophrys gambeli.*

Two specimens taken by Allan Brooks, January, 1914.

WESTERN TREE SPARROW—*Spizella monticola ochracea.*

Regular winter resident.

SHUFELDT'S JUNCO—*Junco hyemalis connectens.*

The majority of the winter Juncos appear to be typical *connectens.* In a series of winter skins sent to Dr. Dwight for identification were

also found *hyemalis and montanus.*

SOOTY SONG SPARROW—*Melospiza melodia rufina.*

Abundant resident.

SPURRED TOWHEE—*Pipilo maculatus montanus.*

One winter record.

BOHEMIAN WAXWING—*Bombycilla garrula.*

Usually an abundant winter resident. Flocks of three hundred or more were not unusual during the winter of 1916-17.

NORTHERN SHRIKE—*Lanius borealis.*

Regular winter resident.

DIPPER—*Cinclus mexicanus unicolor.*

Resident. When the mountain streams freeze over they can be found along the shore of Okanagan Lake. They are conspicuously plentiful at the falls on Okanagan river, where there is always open water. Here their song can be heard even on the coldest days.

WESTERN WINTER WREN—*Nannus hiemalis pacificus.*

Resident. There is a local migration from the mountains in the late fall. This is one of the species that suffered severely in the cold winter of 1915-16.

WESTERN MARSH WREN—*Telmatodytes palustris plesius.*

A few usually winter.

ROCKY MOUNTAIN CREEPER—*Certhia familiaris montanus.*

Resident in the Canadian zone. Common winter resident lower down.

ROCKY MOUNTAIN NUTHATCH—*Sitta carolinensis nelsoni.*

Abundant resident.

RED-BREASTED NUTHATCH—*Sitta canadensis .*

Abundant resident.

PYGMY NUTHATCH—*Sitta pygmæa pygmæa.*

Common resident. Not as widely distributed as the other two species.

CHICKADEE—*Penthestes atricapellus atricapellus.*

Abundant resident.

MOUNTAIN CHICKADEE—*Penthestes gambeli gambeli.*

Abundant resident.

COLUMBIAN CHICKADEE—*Penthestes hudsonicus columbianus.*

Resident in the spruce forests of the Canadian zone. I have never known them to descend to the pine and douglas fir country lower down the mountains. They travel in smaller bands than other Chickadees and keep to the tree tops. Their note is finer and more sibilant and is easily recognized..

WESTERN GOLDEN-CROWNED KINGLET—*Regulus satrapa olivaceus.*

Common resident.

SITKA KINGLET—*Regulus calendula grinnelli.*

One winter record, December 29, 1913.

TOWNSEND'S SOLITAIRE—*Myadestes townsendi.*

Common resident. In the winter their favorite food is the berry of the western red cedar. They remain all winter in the rough broken country of canyons and slide rock, where this dwarf cedar grows, and it is a wonderful experience to hear several males singing their clear sweet song, in these surroundings, when the temperature is at zero.

WESTERN ROBIN—*Planesticus migratorius propinquus.*

A few usually winter.

VARIED THRUSH—*Ixoreus nævius nævius.*

Resident. There is usually a local migration from the mountains in October.

WESTERN BLUEBIRD—*Sialia mexicana occidentalis.*

Five wintered in the city of Vernon in 1915-16. They were seen feeding on virginia creeper berries. These birds were probably frozen in the cold weather that came in January as they were not seen after December 31.

INTRODUCED SPECIES.

BOB-WHITE—*Colinus virginianus virginianus.*

Introduced some years ago. The winters are evidently too severe, as there has been little increase.

CALIFORNIA QUAIL—*Lophortyx californica californica.*

Introduced in the vicinity of Penticton and south, where they have rapidly increased.

RING-NECKED PHEASANT—*Phasianus torquatus.*

Introduced some years ago. Is now common from Summerland to the boundary.

EUROPEAN PARTRIDGE.

This species has recently made its appearance in the vicinity of Penticton, coming from Washington State.

ENGLISH SPARROW—*Passer domesticus.*

Well established in all the towns in the valley.

NOTES FROM THE JOURNAL OF WILLIAM POPE.

(*Continued from page* 62).

before we arrived at New York they were in great numbers, and the weather was particularly fine. We saw several other sorts of birds; gannets, the white gull and other gulls, the tern, several divers, and ducks; the white gull we had nearly every day quite in the midst of the ocean. These birds must fly a very long distance as they lay their eggs in the clefts of the rocks. Several small flocks of some species of sandpiper were also seen. One of the smallest species of that bird came flying around the ship one day, at least 300 miles from land and seemed much exhausted. We found a great source of amusement in

looking at the various sorts of sea birds we met with, and also the fish. The greatest of the latter we saw was the Grampus, a species of whale. We saw a great many of these fellows, one day especially, May 3rd, about 40½° latitude and 62° and 64° longitude. They were skipping about, throwing out water in clouds. We also saw many porpoises. These latter are very amusing; they follow one another in the water like a pack of hounds or a string of wild geese, rolling and tumbling along over the surface of the water. We did not catch any fish except one cod and one dogfish as the weather was too rough and we were driven too low down to the southward. Every night we had those beautiful sparkling phosphorescent appearances in the sea. Sometimes they were more bright and in greater quantities than other times, the water appearing sometimes full of fire.

May 1st, 2nd and 3rd were very fine, beautiful, clear, pleasant days, and we now began to look anxiously forward to a speedy and safe arrival at our much desired haven.

May 5th. It was very fine to-day. About twelve it fell away to a perfect calm and we prepared our line with the intention of catching some fish, but just as we got them ready the breeze sprung up again favorably and we again went on our way rejoicing, although we lost the opportunity of getting some fresh fish for dinner. One of the steerage people caught a cod, and a dogfish. I observed on this day a brown butterfly about thirty miles from land. It is very delightful after being cooped up in the narrow limits of a vessel for the space of five or six weeks and sailing upon the fathomless deep, to arrive once more in soundings, to see the line thrown out, to hear the cheering voice of the man in the chains, giving out the exact depth of the water, now "by the ma-r-k seven," and then "and a h-a-l-f six" growing less and less at every successive cast.

It is very delightful to see the color of the water changed from the dark blue of the main ocean, to the yellowish tinge of the shallower waters girting the sea coasts, to see quantities of sea weed floating by and many birds that never wander far from land, sure indications that the vessel is approximately towards the end of her voyage. Joy gladdens every heart, smiles appear upon every countenance, from the veriest landsman in the ship, to the oldest and fearless sailor; all alike are moved by the cheering knowledge of being within one day's sail of the looked for port and with a favorable wind diminishing the distance that separates us from the shore at every successive moment. All this is heightened and increased tenfold, by the pleasure of hope and imagination, if the voyager (as most of us were) is bound to a quarter of the globe he has never been before, to other climes and other countries, where many things that meet his observation are totally new and novel, and all are interesting.

May 6th. With a steady gentle breeze and the ship under easy sails, expecting every instant to make the land, as we were then and had been all the morning running parallel with the shore, a man, being sent up to the mast head, made known at last about four o'clock in the afternoon the joyful news that land was distinctly visible upon our larboard quarter, bearing west and north-west. This was hailed with delight and satisfaction by all on board, and every eye was immediately directed to that quarter until at length arising above the horizon the shore was seen by all. It proved to be the highlands of Neversink, part of the coast of New Jersey. This was the first part of America that I had ever seen. We sailed alongside the shore till about twelve at night, when we laid to, fired our swivel, and burnt blue lights for the purpose of bringing a pilot to us. After waiting a few hours one came, and carried us safely into Sandy Hook, when we cast anchor.

It was an unpleasant misty morning and about the middle of the day, it came on to rain, but notwithstanding these untoward circumstances we all thought that the land and houses, the Island of Staten on one side and part of Long Island on the other, the trees and shrubs just appearing in their spring array, the fruit trees breaking out into full blossom, never had been more beautiful and verdant, or so pleasing and interesting before. In the course of the day, which was the 7th May, our vessel lying about three or four miles from the city of New York, a steamboat came alongside and carried all those that were ready and willing on shore. Our ship did not get into dock until the next morning.

I had no time for making observations upon first landing as the rain poured down in torrents, obliging me to steer directly for the nearest inn or hotel. In the latter part of the day the weather cleared up, the sun came out, and I immediately proceeded to take a stroll through some parts of the city. I was much disappointed with the appearance of the streets, for they were pretty generally covered with a thick mass of dirt, mud, and filth. A bad custom they have also of placing casks, packages, and all kinds of goods, upon the pavement in front of the shops or stores as they are here called, scarcely leaving sufficient room for the public to pass.

(*To be continued*).

THE MEADOW MOUSE OR VOLE.

By J. DEWEY SOPER, PRESTON, ONT.

Perhaps among the smaller mammals, few are known so well, at least superficially, as the common meadow mouse or vole (*Microtus*), the form common to and occurring over Ontario entire, being *Microtus pennsylvanicus*. The voles are widely distributed and offer

exceptional opportunities for study, owing to their abundance, and to the fact that they do not burrow but remain above the ground.

They are thick, low set animals, of a dark brownish color, darker over the back, caused by the glossy guard hairs, becoming lighter on the sides and reaching their extreme paleness on the under parts. Their legs are short and sturdy, the eyes normal, the ears are small*, and the tail is short, but seldom if ever shorter than the hind foot. Their average size, taken from many specimens in my collection, is the following: Length, 144 mm.; tail, 37½ mm.; foot, 20 mm. All of these characters are, however, subject to variation and slight departures, at least, can be expected.

The above species is very closely related to those of the genus *Synaptomys* and *Phenacomys* but its certain identity is made possible by constant and distinct cranial and dental characters. An important difference, and one most readily appreciated, if the skull is available, is the formation of the teeth. In *Synaptomys* the upper incisors are grooved, while the lower incisors are rooted on the inside of the molars and terminate opposite the posterior molar. *Microtus*, on the other hand, has no grooves on the upper incisors, and the lower incisors cross the line of the molar series between the second and third molars and terminate in the ascending ramus of the mandible behind the posterior molar. This and the preceding genus have in common, rootless molars. *Phenacomys* has upper incisors ungrooved similar to *Microtus*, but the molars in contradistinction to the latter are rooted.

The genus *Microtus* enjoys a circumpolar distribution and ranges over its entire area, Old and New World, from the tropic's edge to the northern-most fringe of mammalian life. The species (*Microtus pennsylvanicus*) is, however, peculiar to America, and the animal we know so well throughout Ontario.

This vole becomes at times a menace to agricultural interests, as it is a prolific breeder, bringing forth three or four litters of young a season, with from four to eight young to the litter. Scarcely a month from April to September but nests of young have been found, and when a region becomes over-run they migrate over to other parts of the country, giving rise in years of abnormal increase to "vole plagues" which are so devastating to crops the country over. They are truly the most destructive of all small animals. Their tastes, while essentially vegeterian, sometimes, no doubt, become carnivorous, as they may readily be trapped by means of a meat bait.

They naturally love the low meadows and grass lands where rank vegetation flourishes, giving them the seclusion they seek. Here they drive their intricate system of runways and tunnelings over the ground, forming a perfect maze of passages, running in all directions, crossing and recrossing.

*In the summer the ears are longer than the fur; in the winter the longer fur conceals the ears.—C.G.H.

It often appears that they are even more industrious in this regard during the winter than during the summer; as in the former case the wonderful network of passages to be seen in the spring when the snow disappears, gives one some idea how industrious these little mammals must be under the blanketing snows. Here in the dim, ghostly light of their subterranean quarters far beneath the snow, in the wintry stillness, one cannot help but picture them scurrying to and fro, from point to point, feeding a little here and there as fancy dictates, upon the roots and stems of the abounding vegetation. And a warm nest of dead grass blades and fibres somewhere in the maze, in which to curl when the cold is intense, and possibly many in one nest cozy and warm.

Sometimes when the snow is not deep their tunnels reach the surface and here in a brief scamper across the snow, they make their way to another tunnel and disappear. These passages over the snow are never of great length, as a rule not exceeding two or three feet, and wisely so, no doubt, for they instinctively feel that a "bolt from the blue" might suddenly end their worthless careers.

Along the banks of ditches and creeks facing the south especially, where the grass is rank, they often have beautiful little tunnels constructed through the growth, leading to a pocket in the bank, completely arched over by vegetation, where they sit and feed. By lifting up the thick growth in these places, one often sees these small temporary dwellings where the mice feed and play. Often a thin deposit of excrement completely covers the floor of these miniature caverns, indicating a prolonged use by the mice for purposes of feeding and retirement.

During the summer they are not so much in evidence, due partly to a more even diffusion of individuals over fields and meadows and also to the fact that the constantly growing vegetation for a certain period, erases the more prominent runways, as seen in winter and spring, but even so their presence may be detected if sharply looked for.

A favorite place at all times is the old fence lines or bottoms, stone piles, decaying rail heaps in dense grass and all similar places. Here they build their nests and rear their young during the warmer months. Oftentimes the nest is cunningly constructed in a hollow cup in the ground or the base of a sheaf in a stook left in place for some time. The nest itself is of neat design and is completely arched over similar to an Ovenbird's nest, but constructed of lighter materials, mostly fine grass blades and plant fibres, with a small almost imperceptible opening on one side, leading to the warm, soft, spherical, interior. The outside dimensions vary, but would probably average about six inches, the interior about three inches in diameter.

The vole has many natural enemies and well it is that Nature has provided for a proper balance in this matter. Among these

enemies are the weasel, mink, skunk, foxes, hawks, and owls. At best a mouse leads a rather erratic and uncertain life and possibly is comparatively short-lived.

A WELL-EARNED HONOUR.

Dr. C. Gordon Hewitt, F.R.S.C., Dominion Entomologist and Consulting Zoologist, of the Department of Agriculture, Ottawa, has been awarded the Gold Medal of the Royal Society for the Protection of Birds, and at the same time was elected an Honorary Fellow of the Society "in recognition of eminent services to the cause of bird protection" in England and Canada. There are but eleven other Honorary Fellows of the Society in different parts of the world. In announcing the award at a recent meeting of the Society in London (England), Mr. Montague Sharpe, Chairman of the Council, recalled the practical support that Dr. Hewitt gave to bird protection before leaving England in 1909 and referred to the many ways in which he had furthered it in Canada, particularly in connection with the treaty between Canada and the United States for the protection of migratory birds. Before coming to Canada, when in charge of the Department of Economic Zoology of the University of Manchester, Dr. Hewitt organized and was secretary of the Economic Ornithological Committee of the British Association for the Advancement of Science and of the Board of Agriculture, which committee of scientific workers undertook the investigation of the economic status of birds in Great Britain and Ireland. He also carried out in the Lake District the protection and encouragement of birds on an extensive scale as a practical measure for the first time in England. His work in promoting bird protection in Canada is well-known, and particularly his efforts to secure the interests of the young and of the people in town and country in the encouragement and protection of birds. At the recent annual meeting of the Commission of Conservation he pointed out that never was the need of bird protection more urgent than at the present time, as birds were our best allies in controlling the innumerable pests that destroy our food crops which are now so vitally essential.

BOOK NOTICE.

RURAL PLANNING AND DEVELOPMENT:—The latest report of the Commission of Conservation deals with the important subject of the planning and development of rural districts and small towns in Canada. It has been prepared by Mr. Thomas Adams, Town Planning Adviser of the Commission, who has made a close study of the

problems of rural development in this country during the past three years, following twenty-five years experience in farming, land surveying and town planning in other countries.

The report deals comprehensively with the social conditions and tendencies in rural areas and the prevailing systems of land settlement and development. It indicates the rural problems requiring solution in order to secure the proper development and economic use of land for purpose of efficiency, health, convenience, and amenity. The great injury which land development in Canada suffers, from speculation, neglect of public health, and want of expert business administration of land settlement, is considered. Incidentally, the problem of returned soldiers is deal with, and the connection between land development and such questions as taxation, unemployment, and high cost of living is clearly shown.

Having regard to the need for more attention being given to production in Canada; to the extent to which production is impaired by speculation in land, by neglect of public health, and by haphazard systems of development; to the importance of increasing the supply of human skill and energy and of capital derived from production instead of by borrowing; the problems dealt with in this report are of vital and current interest to the people of this country.

There are five appendices by competent authorities, and the concluding chapter gives an outline of proposals and makes general recommendations to cover the conditions as presented.

NOTES.

A Club in Boston has for its object the study of mushrooms, for their scientific interest, for their beauty and for their attractive qualities as food. Through the summer and autumn the club has an exhibition of mushrooms once a week at which a number of members come together to compare and identify their fresh collections. Fifty to a hundred kinds are sometimes exhibited. The Club has a large collection of dried mushrooms which are sometimes exhibited in the winter and it has a library of mushroom handbooks and journals. Poisonous species are shown and much pains taken to make them known so that they can be avoided. Membership in the Club is not confined to residents near Boston, and correspondence is carried on with those living at a distance. Persons interested in mushrooms can obtain further information from the Secretary, Miss Jennie F. Conant, 26 Prospect St., Melrose, Mass.

Just as the war in Europe forced a large part of the traveling American public to become more familiar with its own fair land, so has the world conflict been largely instrumental in causing the manufacturer of artistic commodities to look about him here at home for suggestions as to new designs. Notable success in this use of Museum material by industries has recently been made by the American Museum of Natural History in New York.

Now comes the Museum of The Geological Survey of Canada, at Ottawa, with a programme for developing distinctive Canadian designs and placing in the hands of Canadian manufacturers native designs for introduction into their products.

The wealth of material in our American museums, which has not been drawn upon to suggest designs for fabrics, ceramics, jewelry, costumes, etc., is just beginning to be appreciated by a few enterprising manufacturers.

We learn from Nature that the late Lord Justice Stirling's herbarium, consisting chiefly of about 6,000 varieties of mosses and liverworts from many parts of the world, has been presented by Lady Stirling to the Tunbridge Wells Natural History Society.

THE PROVINCIAL MUSEUM AND THE HALIFAX DISASTER.—Mr. Harry Piers, Curator of the Provincial Museum at Halifax, has replied to an inquiry regarding the relation of the explosion to the Museum. The specimens and labels apparently came through fairly well, better than was expected, considering the unbelieveably terrific and astonishingly loud explosion which demolished the Richmond section of Halifax, although windows were blown in, glass of cases smashed, a water pipe burst, and snow stormed into one end of the building. Mr. Piers calls attention to the good results of always using water-proof ink for labels.

The cases were boarded over soon after the explosion in order to use them as tables for Red Cross and other relief supplies, so that a very long or careful examination of the damage has not been made. The publications are in a considerable mess, but probably have not suffered greatly. At the time of writing Mr. Piers had been too busy on relief work to examine into details of the Museum.

Mr. Pier's immediate family escaped injury from window glass which shot across the breakfast room as if from a gun less than half a minute after they had left the table. Hardly a window was left in the house and plaster came down, although the house was two miles from the explosion. His mother's family, living at the head of the North West arm, escaped with numerous small cuts from glass, none of them serious.

HARLAN I. SMITH.

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4B
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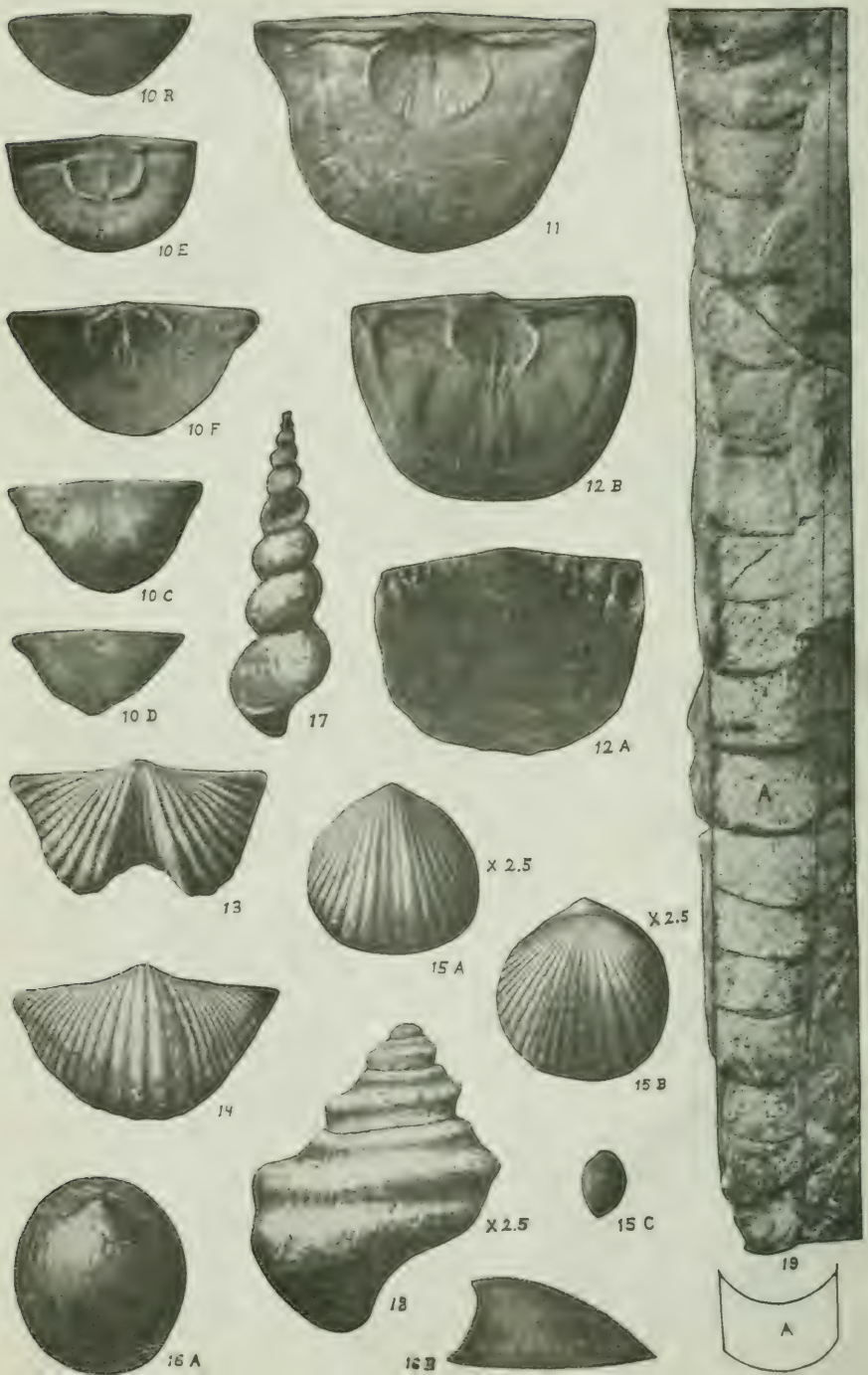
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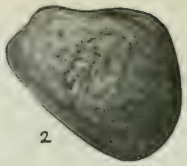
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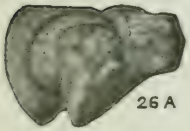
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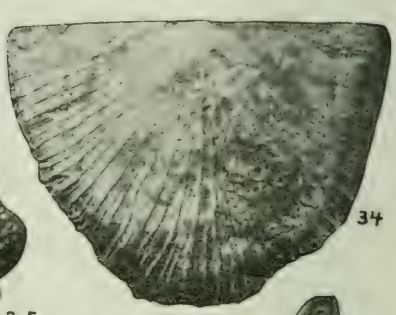
28 B X 2.5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28 A

27 B

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25

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33 C

29 X 2

X 20
33 B

X 20
33 A

30 X 2

31 C
X 2.4

26 B

31 A
X 2.4

31 B
X 2.4

32

X 2.4

THE OTTAWA NATURALIST

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THE RICHMOND FAUNAS OF LITTLE BAY DE NOQUETTE, IN NORTHERN MICHIGAN.

A. F. Foerste.

The fauna of the Richmond exposures along the northern shore of Drummond island evidently is merely a western continuation of that found on Manitoulin island, and extending thence eastward along the southern shore of Georgian Bay and north of the western half of Lake Ontario, almost as far east as Toronto. It contains the same abundance of coralline growths, such as *Stromatocerium huronense* Billings, *Tetradium huronense* Billings, *Columnaria alveolata* Goldfuss, *Calapoecia huronensis* Billings, *Streptelasma rusticum* Billings, and *Protarea richmondensis* Foerste. It contains also the associated fauna known from the Richmond of the Canadian localities just mentioned.

Nothing is known at present of the Richmond fauna on St. Joseph island nor of that part of the northern peninsula of Michigan extending between Lakes Superior and Michigan, until we reach the eastern shore of Little Bay de Noquette, about four miles east of Escanaba, on the opposite side of the bay. Here only the faunal list published by Rominger (Geol. Surv. Michigan, 1873, part III, page 52) is available, and it was for the purpose of supplying further data that the following studies were undertaken.

A lighthouse is located at the southern end of the peninsula between Little and Big Bay de Noquette. The Skaug Brothers store is located two miles north of the lighthouse, and two miles farther north is the present location, in a farm house, of the post office called Stonington. A short distance southward, an east and west section road leads down to the Farmer's Dock. Two miles farther north, at another east and west section road, is the store of J. B. Stratton, and a mile and a half farther north is another road corner, immediately south of which the shallow ditch following the road exposes the basal part of the cherty Richmond, the top of the underlying argillaceous Richmond strata being exposed a short distance farther southward. Passing

from this road corner westward across the farm lands, the following section was measured approximately, with a Locke level:

Base of cherty Richmond.

Interval, upper part consisting of argillaceous Richmond, lower part not exposed	57 ft.
Very coarsely granular limestone	5 ft.
Clay shale with some indurated clay layers and some very thin limestone layers interbedded	21 ft.

The clay shale here mentioned contains *Bollia permarginata*, at various levels. *Clidophorus noquettensis* and *Rafinesquina alternata-varicosa* occur chiefly in the five-foot limestone section.

Three-quarters of a mile south of the Stratton store the base of the cherty Richmond is 32 feet above the level of the bay; directly west of the Stonington post office this interval is 23 feet, and at the Skaug Brothers store it is 19 feet. The dip evidently is southeastward.

The greatest thickness of the cherty Richmond known at present is 14 feet, and this is exposed directly west of Stonington post office, but the top of this part of the Richmond is not exposed here, so that its total thickness is unknown at present. Only the upper part of the underlying argillaceous Richmond was readily accessible at the time of my visit. This presented the following section at the home of Andrew Rheinholdson, three-quarters of a mile south of the Stratton store:

Cherty Richmond, cream-colored limestone	5.5 ft.
Argillaceous Richmond, abundantly fossiliferous, and readily accessible. At the very base of the section *Streptelasma* (?) *divaricans* and *Strophomena sulcata* were collected, and at the very top *Dinorthis subquadrata* occurred. Thickness	11 ft.
Indurated clay layer, spalling off in larger masses, containing *Pholadomorpha pholadiformis* and specimens related to *Modiolopsis concentrica*	2 ft.
Fossiliferous grey-blue argillaceous limestone carrying the same fauna as the overlying layers	6 ft.

Directly west of Stonington post office, the *Pholadomorpha* layer is 16 feet below the base of the cherty limestone, and only 5 feet above the bay. At no locality were the exposures below the *Pholadomorpha* layer well exposed for collecting and practically all the fossils described from the argillaceous Richmond were obtained above the level of this layer.

DESCRIPTION OF FOSSILS.

Streptelasma rusticum (Billings), Fig. 1. Coralla frequently strongly curved as in the specimen figured, but in some individuals the curvature is only moderate. Occurs in the cherty Richmond and in the immediately underlying part of the more argillaceous Richmond. Small specimens of *Streptelasma* (Fig. 2) occur also 10 feet below the cherty Richmond, immediately above the *Pholadomorpha pholadiformis* zone. These specimens have a general resemblance to *Streptelasma divaricans* (Nicholson), especially such forms as occur in the upper part of the Liberty formation in various parts of Clinton county, Ohio, the attachment of the corallum being more or less lateral, frequently with somewhat radicular expansions.

Cornulites corrugatus (Nicholson). Specimens resembling figure 27 on plate 115 of the Palaeontology of New York, volume VII, Supplement, occur in the cherty Richmond.

Lichenocrinus tuberculatus Miller, Fig. 3. Specimens with the plates not as prominently convex, and therefore not presenting as tubercular an appearance as typical forms of the species, occur in the cherty Richmond. The part here figured forms the attachment disk at the basal part of the stem of a crinoid probably belonging to the *Heterocrinidae* (Scyphocrinus and its bulbous root Camarocrinus, Springer, 1917, page 11).

Perenopora decipiens (Rominger) and *Rhombotrypa quadrata* (Rominger) are common in the upper part of the argillaceous Richmond, within ten feet of the cherty Richmond. *Proboscina auloporoides* (Nicholson) occurs in the cherty Richmond.

The specimens of *Crania* occurring in the upper part of the argillaceous Richmond are more or less granulose, but the granules are only about a tenth of a millimeter wide and the distances between them average from one-fifth to one-fourth of a millimeter. In outline they are more or less irregular, as in *Crania scabiosa* (Hall). The diameters of one specimen are 11 and 13 millimeters respectively.

DALMANELLA JUGOSA SUBPLICATA, var. nov., Figs. 4, A, B, C. Specimens resembling the forms figured are common in the upper part of the argillaceous Richmond. Compared with *Dalmanella jugosa* (James), from the Waynesville formation of southern Ohio and neighboring states, they show a tendency toward low folds corresponding to the more prominent fascicular areas among the radiating striae, especially in case of the pedicel valve. The median depression of the brachial valve tends to be narrower, with the immediately adjoining low folds on each side forming a less divergent angle. The term *Dalmanella meeki* was proposed by Miller (Cincinnati Quarterly Journal of Science, 1875, page 20) for specimens described and figured by Meek (Ohio Palaeontology, vol. I, 1873) and which Meek

regarded as identical with *Dalmanella emacerata* (Hall), but which Miller, owing to his more intimate knowledge with Cincinnatian fossils, recognized as distinct. The type of this species evidently is the specimen represented by figures 1 a, b, and c on plate VIII of the Ohio Paleontology. This specimen Meek describes as "of the same form as one of the typical examples." Under the heading: Locality and position, on page 111, he gives its horizon as "Cincinnati group, Cincinnati, Ohio, at an elevation of 250 feet above the Ohio; this being the typical form, like Prof. Hall's fig. 1, in the Regents' Report," the reference being to the 15th Regents' Report on the State Cabinet of Natural History of New York. The elevation mentioned is 50 feet above the top of the great range of strata in which different varieties of *Dalmanella multisecta* (Meek) are more or less common. Here it occurs in the lower part of the Fairmount member of the Maysville group, immediately above the *Strophomena planoconvexa* Hall horizon. It formerly was well exposed at this horizon at the Avondale power house, on Hunt street, and at many other localities within the limits of Cincinnati. Figure 1d, on the same plate, also from Cincinnati, is a typical specimen of *Dalmanella fairmountensis* Foerste; the same species occurs at the top of the hills on the western side of the river at Hamilton. The various specimens represented by figures 2 a-g, on the same plate, probably are representatives of the species which is so abundant in the Waynesville member of the Richmond in southern Ohio and neighboring states, and which later (Paleontologist No. 4, 1879) was described by James as *Orthis jugosa.* It evidently was the intention of Meek to describe these specimens from a higher horizon as a separate species, probably owing to the suggestions of James who supplied him with the various brachiopoda described by him from the Cincinnatian localities. Before final publication, however, he evidently abandoned this idea.

Specimens (Figs. 5 A,B, C) identical with *Hebertella alveata* Foerste occur in the upper part of the argillaceous Richmond, but these specimens are associated with others in which the median depression is confined to a limited area near the beak, as in *Hebertella occidentalis* Hall.

Dinorthis subquadrata (Hall) occurs both in the cherty Richmond and in the immediately underlying part of the argillaceous Richmond.

Most of the specimens of *Platystrophia* occurring in the upper part of the argillaceous Richmond have an aspect somewhat similar to that of *Platystrophia clarksvillensis* Foerste (Fig. 13), from the Waynesville and Liberty members of the Richmond in southern Ohio and adjacent states, however, an occasional specimen resembling *Platystrophia acutilirata* (Conrad) (Fig. 14) from the Whitewater member of the Richmond, also occurs.

Leptaena unicostata (Meek and Worthem), Figs. 7 A, a, B, b. Types used for figures 11a, and 11b, on plate IV, accompanying the original description in volume III, of the Geology of Illinois, 1868. From Maquoketa strata at Savannah, Illinois. Types numbered 12017 in the Worthen collection at the University of Illinois, and examined owing to the courtesy of Prof. T. E. Savage. Figures introduced here for comparison with *Rafinesquina breviusculus.* Notice the relative flattening of the greater part of the pedicel valve, the geniculation of the anterior part of both valves, the straightening of the anterior margin and the consequent angulation of the anterior outline on both sides of this straightened part. The radiating striations, although numbering 4 or 5 in a width of one millimeter, are distinctly leptaenoid, being broad and flat and separated by very narrow interspaces.

RAFINESQUINA BREVIUSCULUS, sp. nov., Figs. 6 A, B, b, C, c, D. The size and general outline of this species is sufficiently indicated by the accompanying illustrations. Figures b and c indicate the amount of curvature, along the median line, of the exterior of the pedicel and brachial valves illustrated by figures 6 B and C. The interior of the brachial valve is thickened along the anterior margin along a narrow area crossed by vascular markings, and here the interior of the shell has a somewhat leptaenoid appearance. However, there is no geniculation such as that characteristic of the genus *Leptaena.* The curvature of the pedicel valve increases slightly toward the beak and much more rapidly toward the anterior border. The muscular area of the pedicel valve, not figured, is broad and flabellate, similar to that of other species of *Rafinesquina,* but only weakly defined. From 4 to 6 radiating striae occur in a width of one millimeter at a distance of 20 millimeters from the beak, averaging about 5 in one millimeter. The median striation often is more distinct than the remainder, but not prominent. Common in the upper part of the argillaceous Richmond. Readily distinguished from *Strophomena parvula,* in the same strata, by the convexity of the posterior parts of the pedicel valve.

RAFINESQUINA PERGIBBOSA, nov. sp., Figs. 8 A, B, C, D. Pedicel valve strongly convex, almost hemispherical in the more obese specimens, with the greatest convexity about two-fifths of the length of the shell from the beak. This strong convexity is maintained to within a short distance of the postero-lateral angles and sometimes produces an abruptly auriculate appearance here. The more prominent radiating striations occur at intervals of less than a millimeter, and the intermediate spaces are occupied by three much finer striae. The interior markings of the brachial valve are boldly defined and are well represented by the accompanying figures. Usually there is a well defined ridge parallel to the anterior prolongation of the median

elevation on each side of latter near the central part of the valve. In the upper part of the argillaceous Richmond.

RAFINESQUINA ALTERNATA (Emmons). Mose of the specimens in the upper part of the argillaceous Richmond are nearly flat (Fig. 9) or are only moderately curved, but specimens with stronger curvature also occur. In the limestone interbedded with the shale on the lake shore, about a mile and a half north of the store of J. B. Stratton, specimens occur in which the strong radiating striae are unusually prominent, suggesting the name RAFINESQUINA ALTERNATA VARICOSA, var. nov. (Fig. 34). These shells are of medium curvature, the curvature being greatest about 35 millimeters from the beak.

STROPHOMENA PARVULA, sp. nov., Figs. 10 A-F. Numerous specimens of a small species of *Strophomena* occur in the upper parts of the argillaceous Richmond and also in the overlying cherty Richmond. These are characterized chiefly by their considerable lateral and short anterior extension. The anterior outline varies from more or less evenly rounded to subtriangular and subnasute. This species evidently belongs to the *Strophomena planumbona* group. There is nothing characteristic about the interior of either the brachial or pedicel valve. The surface striations are fine, about 5 or 6 in a width of one millimeter, interrupted at intervals by slightly more prominent striae. This species may be readily distinguished from *Rafinesquina breviusculus* by the flattening of the brachial valve toward the beak, usually accompanied by a gentle concavity, as in all species of *Strophomena*.

Specimens resembling *Strophomena huronensis* Foerste, from the equivalent of the Waynesville member of the Richmond in Manitoulin island, Ontario, occur occasionally in the upper part of the argillaceous Richmond, accompanied by occasional specimens resembling *Strophomena nutans* Meek, and much more numerous specimens of *Strophomena vetusta* (James), Figs. 12 A, B. *Strophomena neglecta* (James), Fig. 11, is fairly common at the same horizon and occurs in the overlying cherty Richmond. In *Strophomena vetusta* the radiating striae on the brachial valve are relatively coarse; those on the pedicel valve are very fine and often are crossed by fine irregular concentric wrinkles; along the hinge line both valves are wrinkled more or less perpendicularly; and the muscular area of the pedicel valve is subrhomboidal in outline. In *Strophomena neglecta* the radiating striae on both valves are fine and subequal in size, the size of the shell is larger, and the muscular area of the pedicel valve is circular and supplied with flabellate markings. In typical *Strophomena planodorsata* the flattened area occupying the posterior part of the brachial valve forms a larger part of the valve and the muscular area of the pedicel valve is relatively larger.

Strophomena sulcata (Verneuil) occurs 10 feet below the base of the cherty Richmond, immediately above the *Pholadomorpha pholadiformis* horizon, and also at higher horizons in the argillaceous Richmond, associated with *Dinorthis subquadrata* and *Dalmanella jugosa subplicata.*

ZYGOSPIRA RECURVIROSTRIS TURGIDA, var. nov., Figs. 15 A, B, C, evidently is closely related to *Zygospira recurvirostris* (Hall) and *Zygospira kentuckiensis* James. In all of these forms the plications are subequal in size, the median area of the pedicel valve is not distinctly limited laterally, and the median depression of the brachial valve anteriorly is broad and relatively shallow. In the variety *turgida* the brachial valve is more convex than in either of the other two forms when specimens of the same small size are compared. The variety evidently is nothing but a Richmond representative of the Trenton species *Zygospira recurvirostris.* It occurs in the upper part of the argillaceous Richmond.

Specimens resembling *Clidophorus neglectus* Hall (Fig. 24), from the Maquoketa of Wisconsin, in outline and general appearance, occur in the cherty Richmond. A much smaller species, CLIDOPHORUS NOQUETTENSIS, sp. nov., Fig. 25, 3 to 4 millimeters in length, is very abundant in certain layers of limestone interbedded with the shales on the lake shore a mile and a half north of the store of J. B. Stratton. This species is referred to *Clidophorus* on account of the incision made by the clavicular ridge defining the posterior part of the anterior muscular scar, and the absence of any distinct elevation of the casts of this muscular scar in interior casts of this shell, such as occurs commonly in interior casts of typical species of *Ctenodonta.* The shell is relatvely shorter than in *Clidophorus neglectus,* and is less produced anterior to the clavicular ridge; the latter is strongly defined and is either vertical or slightly inclined toward the front. In the casts of the interior the beak rises distinctly above the level of the upper margin of that part of the cast which lies anterior to the impression of the clavicular ridge. The umbonal ridge is fairly strong and is sufficiently oblique to give the shell a ctenodontoid appearance.

In Rominger's list of fossils from the area here discussed. along the east shore of Little Bay de Noquette (Geology of Michigan, vol. I, Part II, 1873, page 52) an undetermined species of *Cyrtodonta* is included. Specimens having a general cyrtodontoid appearance occur in the cherty Richmond, and two of these are here figured. but the hinge and teeth are not distinctly defined in the specimens collected so far and hence their generic relations are not definitely determined. One of these, Fig. 22, bears some resemblance in outline to *Cyrtodonta affinis,* Ulrich, and the other, Fig. 23, to *Cyrtodonta persimilis,* Ulrich, both of which are Black river forms occurring in the Minnesota area.

(*To be continued*)

SOME HABITS OF TWO BURROWING SPIDERS IN MANITOBA.

BY NORMAN CRIDDLE, DOM. ENTOMOLOGICAL LABORATORY, TREESBANK, MAN.

Among the various natural objects met with in the vicinity of the writer's home in Manitoba, none have induced more enquiries as to their origin than the numerous open holes made by the large burrowing spider *Lycosa missouriensis* Banks. These holes are, in fact, met with wherever the soil is sandy and towards winter become very conspicuous on account of the ring of sand thrown around them by the digging spiders. The writer has long since been interested in these creatures and, more than twenty years ago, commenced some observations relating to their winter habits. Owing to the difficulty of securing their names at that time, however, the notes were laid on one side. During the summer of 1917 the old interest was revived through a visit to Treesbank, of Mr. J. H. Emerton, of Boston, Mass., the following notes being a result.

Two species of burrowing spiders are involved in these studies both sand-loving but partial, nevertheless, to certain local conditions of soil. *Lycosa missouriensis* is always found close to vegetation and prefers a situation where dead herbage of some sort is available for the construction of a turret around the entrance to its hole. *Lycosa wrightii* Em., on the other hand, inhabits the bare sand dunes only and constructs no turret. Hence, while these two species may be met with in close proximity they seldom, if ever, invade the other's territory for burrowing purposes. In life *L. wrightii* is at once told from *L. missouriensis* by its black venter.

The life-habits of these two species have already been described by Mr. Emerton* and need not, therefore, be repeated here. This paper, consequently, will be confined to a description of the burrowing habits and such other features as have not previously been touched upon.

In summer time, the excavations of both of these spiders are comparatively shallow, those of *L. missourienses* being about 9 inches in depth, while those of *L. wrightii* are slightly deeper. It is not unusual to find females, when the young are upon their backs, with holes only three or four inches deep. As autumn approaches both these spiders commence to either deepen their burrows or prepare new ones. There is much variation in the dates when individuals begin to do so. In 1917, some were at work on August 2, while others did not commence to dig for more than a month later. There is good reason to

*Phyche, Vol. XIX, No. 2, 1912.

suspect that this variation has to do with the pairing of the sexes and that females do not commence to burrow until after they have become fertilized. The mature males, of course, die before winter sets in.

On September 16, 36 adult burrows of *L. missouriensis* were measured and were found to have attained an average depth of 3 feet 1 inch, the deepest being 5 feet 3 inches and the shallowest 1 foot 4 inches. The deeper burrows had not been further extended for some days, while the spiders were busily at work with the shallower ones. By October 1, many holes had been closed and a measurement of 9 of these indicated an average depth of 3 feet 9 inches. 17 holes still open, but showing no recent signs of digging, averaged 4 feet 1 inch in depth. 15 holes in which the spiders were still digging showed an average depth of 3 feet 7 inches. The deepest closed hole was 4 feet 5 inches, the deepest open one 4 feet 10 inches. Closed holes are thoroughly covered in with grass, leaves and sand fastened together with web in such a way as to make them practically water tight. It was observed that the earliest closed burrows were always in shady situations which would indicate that the shadow had induced an earlier closing than in the case of those exposed to the sun. Burrows in low, wet, lands are shallower than those on the higher lands. 33% of the spiders were still digging on the above mentioned date.

On October 5, about 22% of the adults had closed their holes though all the young were still digging.

On October 8, cold weather seemed to have induced a closing of nearly all burrows, only a few of the smaller ones remaining open. 20 adult holes on high land had an average depth of 5 feet 1 inch, the deepest being 5 feet 8 inches and the shallowest 4 feet 4 inches. Measurement of young spider burrows indicated an approximate depth similar to those of adults.

On November 5, a mature individual was dug out at 4 feet 7 inches. This burrow though perpendicular in direction, had numerous small curves, due to the spider having encountered obstacles in digging. For the first 3 feet this hole was rather densely lined with web but became less so towards the bottom. It had also been stopped with sand at several places, the sand being held in place by web. This spider was found, at the bottom of her burrow slightly sluggish but with sufficient energy to defend herself. A young example provided a similar burrow but slightly deeper. It was stopped at two places. The ground at this time had been frozen to a depth of four inches for some days but at the time of observation was thawed out. These two individuals were placed in the warm sun and became quite active; they refused, however, to dig a new burrow and had moved but little by the next day.

As *L. wrightii* was not found in such close vicinity it did not receive the careful attention given to *L. missouriensis*. Judging from

hasty visits to its home, however, it does not appear to differ very markedly in habits from the latter. A full day spent in the Spruce Woods Reserve on October 13, where the species is numerous, discovered most of the burrows closed but here and there spiders would be found busily at work. The holes were always in pure sand, though occasionally they might be located in places where the grass was sparse or even near ground cedar, *Juniperus horizontalis*. It often happens, with this species, that the coverings of the holes are broken away by the drifting sand, thus giving them the appearance of having never been closed. In several instances of this sort the spiders had abandoned their burrows, while on other occasions a stoppage of the hole lower down had protected them from the falling sand. Abandoned holes of both this spider and of *L. missouriensis* are quite frequently met with, doubtless due to the death of their owners. There is reason to suspect that very late burrowing individuals are those which have been obliged to abandon a previously prepared home. The fact that *L. wrightii* does not construct a turret around its hole is doubtless due to the fact that a turret would catch the wind in such an exposed situation and so be blown away. The holes, unlike those of *L. missouriensis*, are closed entirely with a mixture of sand and web, no vegetation being used in the process. 22 adult burrows were measured, the average depth of which was 4 feet 7 inches, the deepest being 5 feet 7 inches, and the shallowest 4 feet 1 inch. These holes were all closed and had been so for some time.

The burrows of *L. wrightii* being in pure sand are more thoroughly lined with web than are those of *L. missouriensis*. This, of course, serves a double purpose, namely, to enable the spiders to climb up readily and to prevent the loose sand from dislodging. During the summer, holes have to be continually cleaned out owing to the drifting condition of the sand and in late autumn a majority of the closed holes are very soon hidden through the same agency. The opening of burrows in spring time is largely governed by meteorological conditions, and is doubtless induced by a thawing out of the ground around the hibernating spiders. Thus, during an early spring, the holes are opened by the end of April, while in other years they have remained closed until the middle of May.

Both these large spiders are much attacked by parasitic and predacious wasps which they greatly fear. The males are particularly subjected to these attacks while wandering in search of females during September, and fall ready victims to the determined onslaught of their dreaded foes. It is true that the spider will fight in desperation when overtaken but the result is, apparently, always the same. Some species of *Pompilus* boldly enter the spider's burrows and attack the occupants. On July 7, 1916, the writer observed an example of *Pompilus scelestus* Cr. enter a burrow of *L. wrightii* and shortly afterwards

emerge again. An examination revealed the spider in a torpid condition with a large cylindrical shaped white egg attached to the under side of its abdomen. This spider was placed in a glass vial and on the 8th had fully recovered its activities. It ate flies readily thereafter and was kept alive until July 15, when being unable to longer resist the sapping of its vitality by the large larva, which the *Pompilus* egg had produced, it died. This *Pompilus* larva had in seven days attained a truly remarkable size and was almost 20 mm. long at the time of the spider's death. It only survived its host, however, for a short time, so that the further stages of its life could not be ascertained. This is but a single example of the many tragedies that occur in, or around, the spiders' homes Wasps of many kinds roam these sand dunes in large numbers and there is no doubt that spiders form quite a large percentage of their prey. That the spiders in their turn, have found it a profitable hunting ground is equally demonstrated by the large number present in the neighbourhood.

A NOTE ON THE MIGRATION OF THE BARREN GROUND CARIBOU.

By E. M. KINDLE.

There is perhaps no more curious and interesting phenomenon connected with the wild life of Northwestern Canada than the semi-annual migration of the Caribou, *Rangifer arcticus*. The vast herds of these deer, which summer in the barren lands far to the east of the Mackenzie river, move southward in the late autumn from the treeless barrens of the Arctic slope and seek the shelter of the forested region east of the Slave and Athabasca rivers. The writer traversed both of these rivers and a part of the Mackenzie river during the past summer but neither saw nor heard of any caribou having been observed during the summer. With the coming of winter, however, they appeared east of the Slave river in vast numbers, as the following letter from Inspector K. F. Anderson of the R. N. W. Mounted Police clearly indicates.

R. N. W. M. Police,
Fort Fitzgerald,
December 15, 1917.

E. M. Kindle, Esq.,
Ottawa.

My dear Mr. Kindle:

There is nothing new here except the Caribou. They are within forty-five miles of this place in tens of thousands and the natives are getting numbers of the animals and will therefore have plenty to eat this winter. The Deer (Caribou) are passing

north coming from the Southeast, most likely from Fondu Lac on Lake Athabasca. They could not cross there on account of late frosts and swung around towards Great Slave Lake. They say the animals are scattered over hundreds of miles, and literally in millions; the farther east one goes, so they say, the more there are and the buffalo on the plains in the long ago is not a patch on this for numbers. Eventually they land in the barren grounds where nobody bothers them until they take another treck. I sent the Sargeant out on a patrol to see and he reported that the snow is tramped down for miles as close as ice by the animals feet where they passed in great numbers. It is most wonderful!

It is cold up here now and has been for about twenty days, always from 20° to 36° below zero and sometimes blowing.*

I remain,

Yours sincerely,

(Sgd.) K. F. Anderson.

It appears from Inspector Anderson's letter than an important element in directing the course followed by the caribou in their winter wanderings is the date of the freezing of the narrows of Lake Athabasca at Fondu Lac. The early coming of ice there permits the herds to cross and winter farther to the south, so that they would be likely to pass at a great distance to the east of Fort Fitzgerald. When the lake remains open at that point till late, as happened this season, the migrating columns seem to be diverted in a northwesterly direction.

Preble** reports that "During the winter of 1900 the caribou approached the Slave river within a half day's journey east of Fort Smith (sixteen miles north of Fort Fitzgerald) for the first time in many years."

Mr. W. J. McLean,§ a former chief factor of the Hudson Bay Company who observed the arrival in late summer of the caribou in the region north of Lake Athabasca several years ago, described their movements as follows: "It was very interesting to watch these animals which were then marching in their annual tour. They scarcely appeared to take any rest, or halt, excepting for three or four hours in the middle of the night. They kept travelling in continuous bands along the lake towards its north-east extremity and appeared to be impelled by some mighty power over which they had no control. They have regular and well trodden paths which they keep without deviation even when fleeing from their enemy."

With reference to the extraordinary number of the caribou reported by Inspector Anderson it may be noted that his estimates are in accord with those which have been recorded by various other observers.

*A letter from W. G. A. McNeil Wood, Buffalo Range, dated Jan. 18, reports a maximum temperature to that date of 71½° at Fort Smith.

**North Amer. Fauna No. 27, p. 137.

§Man. Hist. and Sci. Soc., Trans. No. 58, Feb. 12, 1901, p. 6.

During the summer of 1893 while travelling northward between Athabasca lake and Chesterfield Inlet the Tyrrell brothers† saw on the shores of Carey lake about latitude 62° 15′ a herd estimated to contain from 100,000 to 200,000 individuals.

In 1877 the caribou are reported to have crossed the north arm of Great Slave lake on the ice in an unbroken line which was fourteen days in passing and in such a mass that in the words of an eye witness "daylight could not be seen" through the column.‡

Wharburton Pike saw enormous numbers of caribou at Mackay lake, October 20, 1889 and says:—

"I cannot believe that the herds of Buffalo on the prairie ever surpassed in size *La Foule* (the throng) of the Caribou. *La Foule* had really come and during its passage of six days I was able to realize what an extraordinary number of these animals still roam the Barren Grounds."

Ernest Thompson Seton gives the following description of the migration of caribou as observed by Colonel Jones (Buffalo Jones) in October at Clinton Golden in the Barren Lands:

"He stood on a hill in the middle of the passing throng with a clear view ten miles each way and it was one army of Caribou. How much further they spread he did not know. Sometimes they were bunched, so that a hundred were on a space one hundred feet square; but often there would be spaces equally large without any. They averaged at least one hundred caribou to the acre; and they passed him at the rate of about three miles an hour. He did not know how long they were in passing this point; but at another place they were four days and travelled day and night. The whole world seemed a moving mass of Caribou. He got the impression at last that they were standing still and he was on a rocky hill that was rapidly running through their hosts."

Even halving these figures to keep on the safe side, we find that the number of Caribou in this army was over 25,000,000. Yet it is possible that there are several such armies."

It is reassuring as regards the future of Canada's big game to learn from Inspector Anderson that the caribou still exists in numbers which are comparable with those reported by these earlier observers.

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†Can. Geol. Surv. Ann. Rept. vol. IX, n. ser. 1898, p. 165.
‡Frank Russell Expl. in the Far North, p. 88, 1898.

NOTES ON THE EVENING GROSBEAK (HESPERIPHONA VESPERTINA).

By F. W. Warwick, B.Sc., Buckingham, P. Q.

As about this time of the year, ornithologists are on the lookout as to the probability of the Evening Grosbeak visiting this district, a few notes I have made upon the species may not prove altogether uninteresting, and go to show that we cannot depend upon its reappearance year after year.

January 7th, 1910.—A flock of Evening Grosbeaks numbering twenty birds have been around town for a week, or more, spending a good part of their time in the mountain ash trees in our grounds, and feeding upon the seeds thereof. The branches of one of these trees coming within five feet of some of our windows, gives us a good chance to study them. They are very handsome, tame, and interesting.

December, 1914.—The Evening Grosbeaks are with us again.

December 15th, 1916.—A flock of seventeen birds of this species put in an appearance to-day, and are gorging themselves on the Rowan and Barberry seeds. This flock remained with us all winter, and had increased by April to forty-two specimens, which were doubtless congregating for their flight westward. Any hour of the day they were to be seen in the Rowan trees, on the ground, or adjacent trees, and made a beautiful sight. They became exceedingly tame and fed within four feet of us, helping themselves occasionally to grit from the ash pile. As the snow disappeared they would feed upon the seeds laid bare.

May 2nd, 1917.—A flock of some twenty birds are still with us, now feeding upon the seeds of the Manitoba maple, and other seeds they find amongst the grass.

May 9th, 1917.—Two males still around in the garden. This was the last date they were seen by us.

December 27th, 1917.—At present date have not as yet put in an appearance. An abundance of their favorite food exists.

Children in various parts of Great Britain have been busily collecting the horse chestnuts required for the manufacture of war munitions. The nuts ripened more quickly in some districts than in others. Indications are that at least 25,000 tons of nuts will reach the Ministry of Munitions, but this is only about one eighth of the estimated crop for the country.

NOTES BY "DIGRESSOR."

Recent experiments by British investigators go to show that butter and some forms of oleomargarine contain a substance that promotes growth in the young. Young rats fed on a ration from which all butter and its substitutes had been eliminated, continued to live but did not increase in weight; while adult females fed on the same food failed to produce young. This growth-promoting substance is found in oleomargarine made from beef fats, but is absent from the other butter substitutes manufactured, as many of them are, from other animal fats or vegetable oils.

The conclusion drawn from these facts by an English writer is that while the presence of this substance in food is probably of little importance to adults whose growth is completed, it may have much to do with the health and robustness of children. Plenty of butter in their diet, he says, is indicated. But as the substance is known to exist in eggs and some other comestibles, it seems likely that the ordinary mixed diet long recognised as the most wholesome, will, even in the absence of butter or beef-fat margarine, supply all the needful constituents for growth and health.

This growth-promoting substance seems to belong to a class of food elements, the very existence of which was scarcely suspected until quite recently. Dietetists used to prescribe certain proportions of proteids, carbohydrates and fats producing so many calories, and they told us that if we did not thrive on these, it was our own fault. But it is now recognized that these methods of food valuation were far too coarse. Besides largely ignoring the sapidity of food, which has a great deal to do with digestion and consequently with nutrition, they knew nothing whatever of the astonishing influence of the "vitamines," the first of which was discovered a few years ago in connection with the study of the fatal oriental disease, beri-beri.

Beri-beri, which has been known in China and the East for hundreds of years, is a distressing disease with a mortality as high as 50 per cent. It was formerly attributed to all sorts of causes, such as damp situations, lack of ventilation, decayed food, and fungoid growths on grain. But it was finally traced to an exclusive diet of "polished" rice,—that is damaged rice which, in order to improve its appearance, has been put through a process that removes its outer coating,—and a rapid cure was effected by the use of unpolished rice, or by the addition of the polishings of the treated rice. From this it was evident that the disease was due to the lack of something removed in the polishing process, and eventually the all-essential substance was isolated from the outer layers of the rice grain, and named "vitamine."

It is present only in extremely small quantities, there being not more than 10 grains of it to a ton of rice. But minute as this quantity is, its absence from the rice diet means disease and death.

Similar substances have since been discovered in other foods, always in very small quantities—the vitamine of limes is in the proportion of 1 to 100,000 parts—and their presence in many food-products appears very probable.

The discovery of these unsuspected food constituents throws a great light on scurvy. At one time scurvy was thought to be caused simply by an excess of salt in the diet. Smollett attributed the prevalence of scorbutic affections in the south of France in the 18th century to the salt-laden breezes from the Mediterranean. Generally, however, the dread disease was blamed on imperfectly preserved food, and lack of vegetable diet. But scurvy broke out in modern polar expeditions (such as Scott's in the "Discovery" and Charcot's in the "Pourquoi pas?") which were supplied with the very best of tinned meats and vegetables, all rigidly inspected by the surgeons before being issued to the men, and undoubtedly in sound condition. The explanation is that the preserving process, tinning or salting or drying, destroys the vitamines, and while the foods are otherwise perfectly wholesome, and may be consumed for limited periods without ill results, as a long continued diet, they are fatal.

Up to 20 or 25 years ago, a form of scurvy known as "black-leg" was common among the shantymen of the Ottawa Valley and more particularly among the river-drivers. At that time the shanty bill-of-fare consisted of little but salt pork, beans, bread and tea. But with the variety of food now supplied, the disorder has entirely disappeared.

Scurvy was prevalent in the early mining days in the Yukon, and a gold-seeking adventurer of the writer's acquaintance tells that when he developed symptoms of the malady, his friends made light of it, and advised him to eat raw potatoes and he would be well in a few days. But he felt anxious about his condition, and determined to enter the hospital at Dawson for treatment. In the hospital they charged him $10.00 a day and simply fed him on raw potatoes!

CHARLES MACNAMARA, ARNPRIOR, ONT.

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THE CANADA PORCUPINE.

By Charles Macnamara, Arnprior, Ontario.

The abrading and compacting which all language undergoes in the course of time have changed the "porcus spinatus" or spiny pig, of the Latins into the "porcupine" of modern English. Zoological classification among the ancients was based on very superficial resemblances, and so it is not surprising to find that they regarded this short-legged, thickset rodent as a kind of pig. Numerous species of porcupines inhabit the four quarters of the globe. In the Old World, where the family originated, they are all terrestrial in their habits, and some kinds are armed with quills so enormous that they are often used to make fancy penhandles. The porcupines of the New World are mostly tree-dwellers, and one or two of them have prehensile tails. They seem to have come across from Africa to tropical America by some very early land connection far older even than the fabled Atlantis. Most of them stayed in the tropics, only one genus of two species having extended north of Mexico. These are the yellow-haired porcupine (*Erethizon epixanthus*) of the west, and the Canada porcupine (*E. dorsatus*) of the east.

Although popularly called the "Canada" porcupine, we in this country cannot claim the animal as our exclusive compatriot, for it is a familiar resident of the wooded regions of all northeastern America as far south and west as Pennsylvania and Ohio. In eastern Ontario it is abundant, and in the course of a day's drive in the spring before the leaves are out, it is not unusual to see three or four of them in the treetops.

Judging the appearance and expression of animals by our human standards, we are often amazed to find some species, like the elephant or the pig, far more intelligent than it looks. The porcupine, however, looks stupid, and is even more stupid than it looks. A large Canada porcupine, Mr. C. W. Nash tells me, sometimes attains to a body length of three feet; but usually an adult is about two feet long exclusive of the tail, and weighs 25 lbs. to 30 lbs. Its body is thick and heavy, and its movements are slow. Its head is small and pointed, with but scant room for the brain, and the little sleepy eyes are almost lost in the long hair; the nostrils are open, and the lips fail to close

over the large orange-colored, chisel-like teeth. The short thick legs terminate in small horny-soled feet armed with long black claws well adapted for climbing. The limbs and the stout body, with the exception of the middle of the back, are clothed with long fine, almost woolly hair. Intermixed with this along the sides and over the nape is a wide band of stiff, coarse, grey-tipped hair about six inches long, and the forehead bears a short tuft of grey bristles. Along the middle of the back and out to the end of the short tail grows a dense mass of erectile quills, mixed with a few long black hairs. The quills are of all lengths from less than an inch to three and a half or four inches long. In addition to this principal mass, there is a scattered growth of short but stout quills concealed in the hair all along the sides and over the head, extending low down on the forehead and above the eyes. Only the underparts of the animal are entirely free from the spines.

I have never come across the young of the porcupine myself, but I am informed by Mr. C. W. Nash that they are born in May, two to four in a litter, and are at birth extremely large in proportion to the size of the adults. They are covered with long black hair interspersed with quills about half an inch in length.

The quills of the adult are white at the base, shading towards the top into yellow and dark brown to black. The largest of them are 3½ inches to 4 inches long (approximately, 90 mm. to 100 mm.) and about 1/16 inch (approximately 2 mm.) in diameter at the thickest part. They are clearly only modified hairs, and various types may be found on the same animal, ranging from plain stiff bristles through slender smooth-pointed spines up to stout needle-sharp barbed quills. The quills are loosely held in the soft fat skin by a conical root with a rounded shoulder, and they appear to come out at the slightest touch. Indeed, before trying some experiments I could not understand why they did not all fall out in the ordinary stress of daily life; and I formulated a theory, that when the quills were in their normal depressed position, they were held in the skin more firmly than when they were erected to stand off an enemy. Herbert Spencer's friends said that the philosopher's sole idea of a tragedy was a beautiful theory killed by a devilish little fact. In my case the little fact was that the quills were *not* held more firmly in one position than in another. Admittedly, the porcupine I experimented with was a dead one, but I cannot see that there would be any difference in the result in life. The truth is that it requires a pull of a quarter of a pound or so to free the quills from their sockets, and no ordinary friction to which they are subjected is sufficient to remove them. But when once the point of the quill is caught in the flesh of an enemy, the barbs hold it so firmly that it readily pulls out of the porcupine's skin.

The barbing, which is so minute that its structure can only be seen under considerable magnification, is formed simply of tiny overlapping scales, like shingles on a roof. To the touch it is only a slight roughness at the point of the quill, but the hold it takes is astonishing. Once the quill makes an entrance, it never draws back, and every movement of the victim only serves to drive the dart in deeper. Its policy, like that of the high-handed Strafford is "Thorough." A hapless dog with his nose, jaws and tongue stuck full of these inexorable little arrows is a most painful sight; and a strong forceps is needed to pull them out.

Obviously, without the protection afforded by its quills, the slow-moving, dull-witted porcupine would fall an easy victim to its many predaceous enemies; but usually wild creatures seem to leave him alone, and those that do attack him are generally sorry for it. Hornaday says that pumas and lynxes have been found in starving condition with their mouths and throats stuck so full of porcupine quills that eating was impossible; and I have heard of horned owls taken with numerous spines piercing their claws.

The only animal known to prey on the Canada porcupine habitually is the fisher (*Mustela pennanti*). This active tree-climber hunts the porcupine assiduously for food, and when it has exterminated them in one district moves on to the next. Its method of attack seems to be to turn the porcupine over on its back and eat it out from the belly. I have seen foxes feeding in this way on a porcupine shot by a wanton hunter. But like the Scotch thistle, the porcupine cannot be assailed with impunity, and a fisher with a taste for porcupine meat always has numerous quills implanted in his head and breast, but which, strange to say, do not seem to incommode him very much. An ancient erorr, still in existence in connection with the porcupine family, is that they can shoot their quills to a distance, and some old writers went so far as to affirm that in this way the porcupine could kill very large animals. Considering that more than 150 years ago the majestic M. Buffon himself went to the trouble of disproving the myth by practical experiments, and that since his time no writer of any standing has attempted to support the fiction, it is very remarkable that it should still be current. It is true that in "Hiawatha" Longfellow commits the double zoological crime of referring to the porcupine as a "hedgehog" and of asserting that the animal "shot its shining quills like arrows," but the fallacy is commonly repeated by people who never heard of "Hiawatha" or Longfellow either. Apparently, like the story firmly believed by most small boys that if you soak a horse hair in water it will turn into a snake, the fable is handed down by oral tradition among the illiterate.

So far from ever shooting its shining arrows, the fact is that beyond erecting its quills and sometimes striking at the aggressor with

its spiny tail, the porcupine always stands strictly on the defensive. He is the original passive resister. One winter morning while breaking my way on snowshoes through a thick growth of alders along the edge of a swamp, I came on a porcupine trying to hide in the hollow butt of an ash tree. Protected by my heavy deerskin mitts, I seized him by the hind legs in order to carry him out into the open with the intention of photographing him. Naturally, he objected to this impertinence, and in his struggles his formidable yellow teeth came alarmingly close to my hand. But the poor creature never made the slightest attempt to bite. His faith was all in his quills: they had failed him, and he knew no other defence. But to carry 25 lbs. of contorting porcupine at arms length with one hand, and my camera and tripod with the other, and to force a way through the brush, all at one and the same time was too much for me, and I had to drop the porcupine. He promptly hitched himself up to the top of a tall young red maple, climbing the smooth bark as easily as a person goes upstairs. This was about noon, and as I left him, it was beginning to snow heavily. I passed the place again on my way home about five o'clock in the evening. It was still snowing, and there was the porcupine clinging to the slender maple top in exactly the same position in which I had left him five hours before, with about four inches of snow piled on his back! I have often wondered how long he stayed there.

Our porcupines occasionally make their dens in a hollow log or under an upturned stump, but their favorite dwelling is in a crevice between the stones of a rocky hillside. They be but a feeble folk yet make they their houses in the rocks. They are confirmed vegetarians, living in a state of nature exclusively on bark and twigs; and being poor travellers they always lodge close to their food supply. This is often a poplar tree, on which they feed continuously night after night —they are mostly nocturnal in their habits—until it is completely stripped of its bark out to the very end of the branches. They also browse on cedars, hemlocks and spruces, but in the case of these conifers, it is the tender twigs that they eat. In the winter, their resorts are readily discovered by the trench-like path they make in the snow from their den to the tree they are feeding on. And their table manners being sadly wanting in refinement, they let many succulent pieces fall to the ground, which are so attractive to the hares, that the snow beneath the porcupine tree is generally trampled hard by the concourse of *Lepus americanus* gathered to feast on these crumbs from the rich man's table.

While the porcupine is a vegetarian, he is not a bigoted one. He feeds on all kinds of scraps around a camp and sometimes he indulges in peculiar hors d'œuvres. Fire rangers often complain that the porcupines eat their cotton posters off the trees; and lately a farmer on

the Bonnechere who left a set of harness in a shed in the woods over summer, found it chewed to pieces in the fall. Like all herbivores, porcupines are extremely fond of salt, and will greedily gnaw anything with a salty taste. I have been told of a camp on the Gatineau where they completely ate away a veranda post that had some brine spilt on it; and a similar example is afforded by the experience of a friend of mine on a canoe trip through Algonquin Park. One night he was awakened by a deep reverberating noise repeated again and again, coming from some little distance down stream. My friend said it sounded like a horse galloping over a wooden bridge, but there was no road within many miles and there was no bridge. At last he got up to investigate, and discovered that the disturbance was caused by a porcupine gnawing the inside of an empty bacon case left on the shore by a drive gang. Under the vigorous rasping of the porcupine's powerful teeth, the boards of the case thundered like a brass drum. But the appetite for salt does not explain why a porcupine last summer gnawed many square feet of the dry weather beaten boards of an old shed at an abandoned mine near Calabogie. Both inside the building and outside, from the ground level up to a height of six or eight feet, he chewed away large patches of the wood, in some places eating completely through the boards. What sapidity he discovered here is a mystery.

It is said that when quarrelling with one of its own kind, the porcupine gives vent to a variety of noises, but the only sound I have ever heard them make is a kind of whining grunt, best described as just about the kind of sound you would expect from a porcupine. But it seldom expresses its emotions vocally, and when assailed it keeps its back to the foe, and maintains a dogged silence. All one winter, my friend Mr. Armon Burwash and I paid weekly visits to a large old porcupine who lived in a hole in the rocks on a bare hillside. We knew he was old, for it must have taken him years to accumulate the dirt that matted his quills together, and which exhaled a strong, but truth to tell, inoffensive enough, odor of cedar. The den was simply a low tunnel open at either end, and roofed over with a couple of large blocks of limestone. We always found him in, though his lodging was in a most exposed situation, open to all the winds of heaven, and on a cold winter's night it certainly could not have been described as cosy. But be it ever so humble there's no place like home, and our friend seemed well satisfied with his quarters. We called him our friend, but it is doubtful if he reciprocated the sentiment. Mr. Burwash suggested that he used to say to himself when he heard us coming: "Confound it, there are those two hanged nuisances again!" For every week we tried some new scheme to drive him out of his den; but all in vain. We reached in through a hole in the roof and slapped him on the back, the only result being a dozen long

quills stuck firmly in our buckskin mitts. By poking a stick in one end of the tunnel, we tried to force him out of the other end; but he would have evidently suffered death rather than move an inch. An attempt to smoke him out with a smudge choked and blinded us, but had no effect whatever on the steadfast porcupine. So, not wishing him any real hurt, we at last gave up, and left him to the cold comfort of his wind swept hillside.

An ambition of mine has long been to get a good photograph of a porcupine in his native wilds. They are plentiful enough, but one generally sees them high up in the tree tops or finds them wedged inaccessibly into a crevice in the rocks. One day last summer, however, I came on a fine young specimen wandering along the edge of a beaver meadow, and alas! my camera was at home. Next day I had occasion to visit the same place again, but as I thought there was no chance of seeing the porcupine the second time, and the day was very hot, I decided not to burden myself with a camera. And when I came to the beaver meadow, there were *two* porcupines ambling side by side in the grass. The third day I loaded myself with all my apparatus, and set out for the meadow with high hopes. "The third time is the charm." There was no porcupine there, and I have not seen one since.

NOTES ON THE BIRDS IN AN OKANAGAN ORCHARD.

By J. A. MUNRO.

The following notes apply to a ten acre orchard of mixed fruits on Okanagan Lake, B.C. The fruit trees are planted on a narrow strip of land, at the base of an abrupt rise. Behind this small hill are a series of benches, originally covered with bunch-grass (*Agropyron spicatum*) and now partly sown to alfalfa. Behind these benches is a steep rocky mountain, five hundred feet in height, covered with a fairly heavy growth of Douglas fir (*Pseudotsuga taxifolia*) and Yellow pine (*Pinus ponderosa*) with several patches of Quaking aspen (*Populus tremuloides*) and Mountain birch (*Betula fontinalis*). A waggon-road has been built close to the shore of the lake, and on the lake side of this road there is a continuous row of various species of wild fruit; chiefly Black haw (*Crataegus douglasi*) Bitter cherry (*Prunus emarginata*) and Service berry (*Amelanchier alnifolia*).

The summer of 1916 was remarkable for the number of birds that visited the orchard, in excess of the normal population of breeding birds. In spite of the abundance of natural food afforded by the wild fruits, many species showed a marked preference for the orchard crop. Italian prunes, sweet cherries, and several varieties of plums

were eaten extensively by Bullock's Oriole (*Icterus bullocki*), Western Tanager (*Piranga ludoviciana*), Cassin's Purple Finch (*Carpodacus cassini*), Catbird (*Dumetella carolinensis*) and Western Robin (*Merula migratorius propinquus*). The largest and ripest fruits were attacked first; generally, only a small portion of each fruit was eaten and in some cases they were only slightly punctured but rendered unfit for marketing. About seventy-five per cent. of the cherries and forty per cent. of the prunes and plums were destroyed.

Of the wild fruits, the Service berry (*Amelanchier alnifolia*) was the most freely eaten; even such species as Tree Swallow (*Iridoprocne bicolor*), Rocky Mountain Hairy Woodpecker (*Dryobates villosus monticola*), Red-naped Sapsucker (*Sphyrapicus varius nuchalis*), and Red-shafted Flicker (*Colaptes cafer collaris*) were seen eating them. Kingbird (*Tyrannus tyrannus*), Northern Pileated Woodpecker (*Phloeotomus pileatus abieticola*), and Red-eyed Vireo (*Vireosylva olivacea*) were partial to the white berries of the Red dogwood (*Cornus stolonifera*).

Mountain breeding birds such as Western Tanager, Townsend's Solitaire (*Myadestes townsendi*), Willow Thrush (*Hylocichla fuscescens salicicola*) and Cassin's Purple Finch came down from the hills as soon as the young were able to fly, and remained in the orchard and the brushy thickets in the vicinity, for the remainder of the summer, or until such as were migratory, departed for the south. During the latter part of July and early August the hills were almost destitute of bird life.

The following species bred commonly in the orchard and in the trees and brush along the lake shore.

Red-shafted Flicker; Western Meadowlark, (*Sturnella magna neglecta*);Western Chipping Sparrow, (*Spizella socialis arizonae*); Western Vesper Sparrow, (*Poocaetes gramineus confinis*); Spurred Towhee, (*Pipilo megalonyx montanus*); Kingbird; Arkansas Kingbird, (*Tyrannus verticalis*); Alaska Yellow Warbler, (*Dendroica aestiva rubiginosa*); Cedar Waxwing, (*Bombycilla cedrorum*); Western Wood Pewee, (*Myiochanes richardsoni richardsoni*); Bullock's Oriole; Tree Swallow; Mountain Bluebird.

During the past seven years, there has been a noticeable increase in the number of birds breeding in the orchard and vicinity. During that time much of the sheltering brush has been cut down and a number of houses have been built. The increase is no doubt largely due to the merciless warfare that has been waged against such enemies as crows, magpies, squirrels and chipmunks. These are the chief enemies of orchard breeding birds, but the white-footed mouse (*Peromyscus*) is suspected of being an egg thief. Nests containing eggs, that had been under close observation for several days, were found rifled of their contents, and with the lining of the nest pulled

out and hanging over the rim; as if the horsehair or other fine material, had been caught on the claws of some small mammal. These depredations, apparently occurred at night and were done at a time when squirrels and chipmunks had been cleaned out of the orchard.

The following notes show the gradual increase of mountain-breeding birds and the first movement of the fall migration.

July 12, 1916—A slight increase in the numbers of birds in the orchard. Broods of Audubon Warblers (*Dendroica auduboni auduboni*), Western Vesper Sparrow, Shufeldt's Junco (*Junco hyemalis connectens*), and Calaveras Warbler (*Vermivora rubricapella gutturalis*) appear.

July 15, 1916—The hedge full of birds, feeding on service berries; Catbirds unusually plentiful.

July 26 to July 28, 1916—Hundreds of swallows of all species, passing through.

July 16 to August 8, 1916—A steady increase during this time. Broods of Red-naped Sapsucker, Townsends Solitaire, Wright's Fly-catcher (*Empidonax wrighti*) and Olive-backed Thrush (*Hylocichla ustulata swainsoni*) appear.

August 10, 1916—Large flocks of Cassin's Purple Finch, juvenals and adults arrive.

August 11, 1916—Spurred Towhee, adults and juvenals very plentiful. Several juvenal Western Evening Grosbeak (*Hesperiphona vespertina montana*) and Lazuli Bunting (*Passerina amoena*) seen.

August 12, 1916—Large increase in the number of Bullock's Oriole and further increase of Cassin's Purple Finch.

August 14, 1916—Bullock's Oriole, Cassin's Purple Finch, and Western Tanager very destructive in the orchard. The locally bred robins have left.

August 15 and 16, 1916—The orchard nearly empty of birds.

August 17, 1916—Large flocks of Shufeldt's Junco, Pine Siskin (*Spinus pinus*), Western Robin and Western Chipping Sparrow arrive. Arkansas Kingbirds and Bullock's Orioles have all left.

August 20, 1916—Nearly all the catbirds have migrated.

August 21, 1916—The common kingbird left to-day.

August 24, 1916—Cedar Waxwing and Cassin's Purple Finch are still numerous. The former prefer the wild fruit to the domesticated.

THE RICHMOND FAUNAS OF LITTLE BAY DE NOQUETTE, IN NORTHERN MICHIGAN.

BY A. F. FOERSTE.

(Continued from page 103).

Pterinea (*Caritodens*) *demissa* (Conrad) is represented by specimens 50 millimeters in height, both in the cherty Richmond and in the upper part of the underlying argillaceous Richmond. At both horizons it is associated with a *Byssonychia* which is similar to the form occurring more or less abundantly in the Waynesville member of the Richmond on Manitoulin Island, in Ontario, but good specimens for figuring are rare.

The *Opisthoptera* occurring in the cherty Richmond bears a general resemblance to *Opisthoptera casei* (Meek and Worthen) but probably is a distinct species. Anteriorly, along the umbonal ridge, the shell is convex and elevated above the more posterior parts of the shell very much as in *Byssonychia,* and this appearance is strengthened here by a tendency of the radiating plications here to remain simple. Moreover, the anterior outline of the shell is concavely curved near the beak and convexly curved below, more as in *Byssonychia* than in typical *Opisthoptera casei.* Along the posterior part of the middle third of the shell, posterior to the umbonal part, the plications are arranged in fasciculate groups, while along the posterior third and also along the anterior margin the plications tend to be narrow, numerous, and subequal. This probably is a new species, but no specimens suitable for figuring have been found so far.

CLIONYCHIA ANGUSTA sp. nov., Fig. 20. This species has been figured so as to suggest a form similar to *Clionychia excavata* Ulrich (Geol. Surv. Ohio, vol. 7, 1893, pl. 51, figs. 4, 5), from the Whitewater member of the Richmond in Indiana. As a matter of fact, however, the specimens at hand do not show any indication of a ligamental area along the upper part of the shell when thus oriented. Compared with the Indiana species, when thus oriented, the shell is narrower and the basal part is more abruptly rounded. It occurs in the cherty Richmond, associated with specimens of *Cymatonota* resembling *Cymatonota typicalis* Ulrich but not sufficiently preserved to make their identity certain. Small modiolopsoid specimens resembling *Colpomya faba* (Emmons) also occur.

Ten feet below the base of the cherty Richmond there is an argillaceous band, 12 to 18 inches in thickness, forming a single layer, usually spalling off in larger masses than the immediately overlying or underlying strata; in this layer fossils, with the exception of certain lamellibranchiata, are few. This is the chief horizon for

Pholadomorpha pholadiformis (Hall), originally described and figured from this locality (Rept. on Geol. of Lake Superior Land District, 1851, page 213, pl. 30, figs. 1 a-c; pl. 31, fig. 1). Here it is associated with a species of *Modiolopsis* curved as in *Modiolopsis concentrica* Hall and Whitfield, but erroneously regarded by Hall as identical with *Modiolopsis modiolaris* (Conrad), from the Lorraine of New York, a form having a relatively straight hinge-line. This form from the Richmond of Little Bay de Noquette is much larger than typical *Modiolopsis concentrica* and probably represents a distinct species. It is more or less abundant in the Lorraine-like strata which form the lower part of the Richmond section in various parts of Manitoulin Island, on the southern shores of Georgian Bay, and north of the western half of Lake Ontario. Among other specimens of *Modiolopsis* found associated with *Pholadomorpho pholadiformis* occurred a specimen, apparently shortened by pressure (Fig. 21), whose affinities for the present must remain in doubt.

The species of *Archinacella* occurring in the cherty Richmond (Figs. 16, A, B), is more circular in outline and more distinctly elevated toward the beak than in *Archinacella richmondensis* Ulrich, from the Whitewater member of the Richmond in Indiana; moreover the concentric striations are rather fine and not distinctly delimited at equidistant intervals. The general appearance of the shell is smooth. Similar specimens occur in the cherty Richmond two miles southwest of Kagawong, on the road to Gore Bay, on Manitoulin Island, Ontario. The shell is regarded as a new species, ARCHINACELLA KAGAWONGENSIS, the specimens from Manitoulin Island forming the types.

In the same cherty Richmond, on the eastern shore of Little Bay de Noquette, occurs *Cyrtolites ornatus,* Conrad, a form of *Hormotoma gracilis* (Hall), *Lophospira bicincta* (Hall), *Helicotoma brocki,* Foerste, and a species of *Conularia.* The *Hormotoma,* Fig. 17, is a thick-shelled form, and is notable chiefly for its size. The *Lophospira,* Fig. 18, has a more angular peripheral and upper carina than the enlarged figure suggests, but there is no evidence of a trilineate peripheral band and the lower volution is distinctly convex for some distance below the lower carina. No fourth carina is present.

Helicotoma brocki, Foerste (Bull. Sci. Lab. Denison Univ., vol. 17, 1912) is common and attains a width of 18 millimeters. The only fragment of *Conularia* found evidently belongs to some fairly large species, and may be identical with *Conularia formosa,* Miller and Dyer, from the Richmond and Maysville groups of Indiana and Ohio.

A single specimen of a species of *Orthoceras* (Fig. 19) resembling *Orthoceras amplicameratum* Hall, from the Trenton of New York, in its rate of expansion and in the ratio of the distance between the septa

to the diameter of the shell, was found loose, about a mile north of the light house at the southern end of the peninsula. Its horizon appears to have been the cherty Richmond. It differs from the Trenton species named in having the septa relatively even more distant, the ratio mentioned above varying from 5 to 8 in 10. The siphuncle apparently was narrow and cylindrical, probably not exceeding a millimeter and a half in diameter where the width of the shell is 15 millimeters.

A species of *Amphilichas* and one of *Chasmops* occur in the cherty Richmond. The fragment of the first (Figs. 27, A, B), as far as preserved, cannot be distinguished from the type of *Amphilichas cucullus* (Meek and Worthen), described from the Kimmswick limestone, in Alexander county, Illinois, (Geo. Surv. Illinois, vol. III, 1868, pl. 1, figs. 6 a, b, c). This type is numbered 12021 in the Worthen collection in the University of Illinois, and was examined through the courtesy of Prof. T. E. Savage. The axial and lateral lobes of the glabella, the occipital segment, and as much of the fixed cheeks as remains, present the same appearance in the Richmond specimen and in the Kimmswick type from all points of view. Although at first sight the Richmond specimen appears to be much more abundantly tuberculated, a close examination of the Kimmswick type indicates the presence of similar tubercles or granules, but those of the Richmond specimen are much more prominent, at least in their present state of preservation. Two figures of the Kimmswick type (Figs. 26 A, B) are here presented. The first presents the left side of the type of the cephalon, and the second illustrates the anterior, so placed as to have the top of the axial lobe parallel with the line of vision .

The associated specimen of *Chasmops,* mentioned above, consists of a fragment presenting the middle and lateral lobes of the glabella and the occipital segment. This is sufficient to indicate the generic reference. In the illustration here presented (Fig. 32), a faint outline of the probable course of the movable cheeks and genal spines is presented, but this part is not preserved in the specimen at hand. For purposes of comparison, several illustrations of *Chasmops breviceps* (Hall) Figs. 31 A, B, C, from the upper part of the Richmond, at Richmond, Indiana, are here presented. The original specimens were collected hereby Mr. John Misener. The only specimens collected by myself were obtained near the top of the Liberty member of the Richmond, along Cowen creek, in Clinton county, Ohio. Here they were associated with *Xenocrinus baeri* (Meek), *Gyroceras baeri* (Meek and Worthen), *Gomphoceras eos* Hall and Whitfield, *Ceraurus miseneri* Foerste, typical pygidia of *Amphilichas harrisi* (Miller), accompanied by a fragment of a glabella (Figs. 28 A, B) bearing the same kind of pustulose ornamentation as the aforesaid pygidia. In this fragment, the strong downward curvature of the anterior part of the

cephalon suggests a form more or less similar to that of *Amphilichas*. However, this fragment of a glabella was not actually found attached to any specimen which could be identified confidently as *Amphilichas harrisi*.

The species originally described by S. A. Miller (Jour. Cincinnati Soc. Nat. Hist., vol. I, 1878, p. 106, pl. 3, fig. 9) as *Lichas harrisi* is a typical *Amphilichas*, a genus characterized by a pygidium in which the axial lobe anteriorly is marked by two transverse rings, while posteriorly it terminates in a point; there are three pairs of pleural segments with free ends. The lateral lobes of the glabella not only reach the neck furrow but are extended along the latter for some distance. *Lichas halli*, Foerste, and the pygidium recently figured by the writer from the Richmond formation at Richmond, Indiana (Jour. Cincinnati Soc. Nat. Hist., vol. 22, No. 2, 1917, page 43, pl. 1, fig. 2) evidently belongs to another genus, possibly *Arctinurus*.

The specimens of *Calymene* occurring in the cherty Richmond are not sufficiently well preserved to be referred to any definite species, although fragments are not uncommon.

Two figures of cephalons of trilobites are here presented in the hope that they may prove of interest, although not belonging to the fauna here under discussion. They serve at least to fill spaces which otherwise would have been left vacant on the plate. *Synhomalonotus christyi* (Hall), Fig. 29, from the upper part of the Waynesville member of the Richmond, is represented by a slightly crushed cephalon. *Pterygometopus carleyi* (Meek), Fig. 30, is represented by an entire enrolled specimen, lacking only the genal spines; but only the cephalon and the outline of the axial part of the first segment of the thorax is here presented. It was obtained in the Fairmount member of the Maysville group, at Cincinnati, Ohio.

BOLLIA PERMARGINATA, sp. nov., Figs. 33 A, B, C. Carapace only three-fourths of a millimeter in length, closely resembling the specimen from the Arnheim member of the Richmond identified by Ulrich and Bassler (New American Paleozoic Ostracoda, Proc. U.S. Nat. Mus., 1908, p. 288, fig. 13) as *Bollia regularis* (Emmons). It differs chiefly in the prominence and continuity of the ventral part of the marginal ridge. The two middle ridges are slightly more elevated than the anterior and posterior branches of the marginal ridge, and are connected at the base so as to produce a more or less U-shaped aspect. They vary from vertical to slightly divergent, with the basal part inclining slightly toward the rear, especially in case of the anterior one of this pair. The anterior branch of the marginal ridge tends to be vertical, and as far separated from the anterior one of the middle pair as the latter are separated from each other. It is located at a distinct interval from the anterior margin of the carapace. The posterior branch of the marginal ridge, however, is marginal, and tends

to be narrower than the other vertical ridges. A very narrow border, Fig. 33 C, extends around the entire carapace, excepting, of course, along the dorsal line. All four vertical ridges are abruptly elevated to a height varying from one-tenth to one-eighth of a millimeter. Very abundant in thin limestone layers, about half a centimeter in thickness, interbedded in the shales, and in much smaller numbers in the shales themselves, about a mile and a half north of the store of J. B. Stratton, along the lake shore.

FAUNAL CORRELATIONS.

Lithologically, the cherty, light-brown or light-blue Richmond limestone, forming the upper part of the section along the eastern shore of Little Bay de Noquette, resembles the cherty Richmond exposed one and a half miles southwest of Kagawong, on the road to Gore Bay, on Manitoulin island. *Archinacella kagawongensis* is common to both localities, but no conclusions can be based upon this species alone. Among the more significant fossils found in the cherty Richmond of the Michigan locality are *Lichenocrinus tuberculatus* and *Dinorthis subquadrata;* the first is known only from the Whitewater member of the Richmond in the typical Cincinnatian areas, while *Dinorthis subquadrata* occurs both in the Liberty and Whitewater members. *Chasmops breviceps* is known by me only from the Liberty member, although listed by Bassler also from the Waynesville. If *Clionychia angusta* is closely related to *Clionychia excavata,* then the occurrence of the latter in the Whitewater member should be noted. Apparently this cherty Richmond limestone may be correlated provisionally with the post-Waynesville portion of the typical Richmond section. *Helicotoma brocki* has been known hitherto only from the lower, or Waynesville member of the Richmond section on Manitoulin island. *Strophomena neglecta* is known chiefly from the upper third of the Waynesville member, although characteristic specimens occur occasionally in the Whitewater member, especially in the vicinity of Richmond, Indiana. The presence of *Amphilichas cucullus* is merely another instance of the occurrence in the Richmond, with very little change, of a characteristic Trenton species. It is very evident that, while the Cynthiana, Eden, and Maysville invasions were taking place in the states bordering on the Ohio river, a large part of the Trenton fauna was able to maintain itself in some other area, as yet unrecognized, and from this area it was able to make a second incursion into the area surrounding Cincinnati. Something similar appears to have taken place in case of the Kimmswick limestone and the upper Richmond in northern Michigan.

The more significant fossils in the argillaceous Richmond limestones on the eastern shore of Little Bay de Noquette include *Hebertella alveata* and *Platystrophia acutilirata,* from the Liberty and

Whitewater members of the typical Richmond, and *Strophomena neglecta, Strophomena sulcata,* and *Strophomena vetusta,* which range from the upper third of the Waynesville member into the Liberty and Whitewater members. In Ohio, *Dalmanella jugosa* is most abundant in the Waynesville member. *Platystrophia clarksvillensis* occurs both in the Waynesville and Liberty members. These fossils may represent a late stage of the Waynsville fauna or an early stage of the post-Waynesville portion of the typical Richmond.

The underlying *Pholadomorpha pholadiformis* horizon is regarded as a part of the Richmond section.

The shale section along the shore of the bay, a mile and a half north of the J. B. Stratton store, lithologically resembles the Sheguindah clay shales of Manitoulin island, but not a single fossil has been found which would warrant such a correlation. The nearest relative of *Bollia permarginata* appears to be *Bollia regularis,* from the basal or Arnheim member of the Richmond. Considering the inadequacy of the small fauna collected it is not worth while to discuss the possibility of this Michigan shale corresponding to the Maquoketa shale of more western states. It may not belong to the Richmond at all. For the present, at least, its correlation must remain in doubt.

PLATE IV.

Fig. 1. Streptelasma rusticum.
Fig. 2. Streptelasma cf. divaricans.
Fig. 3. Lichenocrinus tuberculatus, magnified.
Fig. 4. Dalmanella jugosa subplicata. A, B, brachial valves; C, pedicel valve.
Fig. 5. Hebertella alveata. A, brachial valve; B, C, pedicel valves.
Fig. 6. Rafinesquina breviusculus. A, B, pedicel valves, on the same slab with 10A; C, D, interiors of brachial valves; b, c, outlines of the corresponding valves.
Fig. 7. Leptaena unicostata. Type. A, pedicel valve; B, interior of brachial valve; a, b, outlines of the corresponding valves. Maquoketa strata, Savannah, Illinois.
Fig. 8. Rafinesquina pergibbosa. A, B, pedicel valve and lateral view of the latter; C, D, interiors of brachial valves.
Fig. 9. Rafinesquina alternata. Interior of brachial valve.
Fig. 10. Strophomena parvula. A, brachial valve.

PLATE V.

Fig. 10. Strophomena parvula. B, C, D, brachial valves; E, interior of pedicel valve; F, interior of brachial valve.
Fig. 11. Strophomena neglecta. Interior of pedicel valve.
Fig. 12. Strophomena vetusta. A, pedicel valve; B, interior of pedicel valve.
Fig. 13. Platystrophia clarksvillensis. Pedicel valve.
Fig. 14. Platystrophia acutilirata. Brachial valve.
Fig. 15. Zygospira recurvirostris turgida. A, pedical valve; B, brachial valve; both enlarged; C, lateral view, with brachial valve on left side.
Fig. 16. Archinacella kagawongensis; not the type. A, viewed from above; B, lateral view.
Fig. 17. Hormotoma gracilis, var.
Fig. 18. Lophospira bicincta.
Fig. 19. Orthoceras sp. Curvature of septa limiting chamber A shown separately.

PLATE VI.

Fig. 20. Clionychia angusta.
Fig. 21. Modiolopsis sp. Shortened by pressure.
Fig. 22. Cyrtodonta cf. affinis.
Fig. 23. Cyrtodonta cf. persimilis.
Fig. 24. Clidophorus neglectus.
Fig. 25. Clidophorus noquettensis, enlarged.
Fig. 26. Amphilichas cucullus. Type; A, left side of cephalon; B, anterior view; from Kimmswick limestone, in Alexander County, Illinois.
Fig. 27. Amphilichas cucullus. A, left side of cephalon; B, viewed from above; from Richmond section on east side of Little Bay de Noquette.
Fig. 28. Amphilichas sp. A, left side of glabella; B, viewed from above, magnified; from near top of Liberty member of Richmond, Clinton county, Ohio.
Fig. 29. Synhomalonotus christyi, magnified; Waynesville member of Richmond, at Oxford, Ohio.
Fig. 30. Pterygometopus carleyi, magnified; Fairmount member of Maysville, at Cincinnati, Ohio.
Fig. 31. Chasmops breviceps, magnified. A, cephalon of enrolled specimen; B, imperfect cephalon; C, pygidium of enrolled specimen. From Liberty member of Richmond, at Richmond, Indiana.
Fig. 32. Chasmops sp. middle part of cephalon, with indications of missing parts. From Richmond strata on east side of Little Bay de Noquette.
Fig. 33. Bollia permarginata, magnified. A, left valve; B, right valve; C, posterior view of left valve.

BOOK NOTICE.

OUTLINES OF COMPARATIVE ANATOMY OF VERTEBRATES. By J. S. Kingsley, Professor of Zoology in the University of Illinois, Philadelphia, P. Blakiston's Sons & Co. Second Edition, Revised, 1917; pp. 449; price $2.50.

Students of comparative anatomy will welcome the second edition of Professor Kingsley's text-book which has already proved itself a valuable acquisition to the English-speaking zoological and medical schools. As compared to the first edition, the number of pages of reading matter, as well as text-figures, has been considerably augmented, and a very thorough revision made of the whole work. A knowledge of the derivations of the terms used in anatomy and embryology is undoubtedly of great assistance to the student's memory, and a useful reference list of the most frequently occurring Latin and Greek roots and their meanings has been appended.

It has been the author's endeavour not to treat of anatomical facts only in so far as they affect isolated representatives of several classes, but to correlate and compare these facts with each other and with the conditions in other animals. Thus a more intelligent representation of the subject is made, answering the needs and satisfying the conceptions of modern science. To the zoolgist who must necessarily found his knowledge on the dissection of types, Professor Kingsley's book will supply a deeper comprehension of the "analogies and homologies" of vertebrate structure.

Taking as his thesis the axiom that the "life-history of the individual is a recapitulation of the history of the race," the author builds up his ideas of comparative anatomy around the important basis of embryology. His comparative conception is not always apparent in the text but in a study that is at once detailed and general the difficulty of a broad discrimination is duly recognized. Thus the work might be criticised as not catering to the tastes of the undergraduate in general, but its usefulness in the zoological laboratory and class-room will be greatly appreciated.

In his treatment of the subject, the author demonstrates his exceptional familiarity with animal structure as well as a very extensive acquaintance with the literature of comparative anatomy and embryology, and for these very reasons, one would expect to find a cautious as well as scholarly exposition of the whole subject.

The illustrations, mostly original, constitute a notable feature of the book and the author must be complimented for his great skill as an artist, especially for the admirable stereograms. Unfortunately, the same cannot be said for the outline drawings which are at times too crowded and suffer from lack of contrast. In this respect they fall short of the work of Balfour, Marshall, Flower and Wiedersheim. A few errors still persist in the second edition, both statements of fact as well as typographical. For instance, the statement (p. 132) that "the somatic wall of the mytome does not participate in muscle formation" needs qualification, since it is not true of all vertebrates. Again in Fig. 378, the two oviducts are shown as uniting in a "urinary bladder." On the whole, however, the work will be more than acceptable to morphologists who will feel justly proud both of the author and the publisher who has accomplished his typographic responsibilities in such careful fashion.—A. E. C.

NOTE.

Mr. Alfred T. Davies has written under the title "Student Captives" a short account of the British prisoners of war book scheme, whose object is to provide British prisoners of war interned in enemy or neutral countries with educational books. Much trouble has been taken to provide the prisoners with mental interests, and to make suitable provision for their education so as to enable them to redeem the time of their captivity. Letters of enquiry as to what to send should be addressed to A. T. Davies, Esq., C.B., Board of Education, Whitehall, London, S.W.L., England, and the word "Prisoners of War" written in the left-hand top corner.

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THE BIRDS OF EDMONTON.

By J. Dewey Soper, Preston, Ont.

Considering the geographical situation of Edmonton, the locality possesses a surprising wealth of bird life; not less than one hundred and forty-three species have been recorded from the vicinity.

The superficial survey of a map discloses the fact that Edmonton, Alta., lies in the same latitude as southern Labrador and Ungava, and yet compares very favorably, as regards climate, with parts of southern Ontario, about six hundred miles in latitude to the south. One is forced to reflect that latitude alone is a poor and deceptive medium by which to judge the climatical conditions of a region. On climate, of course, depends largely the existence or non-existence of many of our birds, especially the less hardy species, and of these a generous number are represented in the faunal life of the Edmonton territory.

Two distinct floral conditions exist at Edmonton, one comprising the usual poplar forest of the north-west, and the other the coniferous tracts of the river basins and adjacent ravines. The deciduous growth of the uplands with their deforested areas, interspersed with lakes and marshes, together with the gloomy forests of the river valleys, offer it seems, quite a diversification or latitude in the accommodation of avian life.

My observations were conducted during three summers and two winters, from 1912 to 1914. I have been favored, in making my list as complete as possible, with the numerous references in Macouns' Catalogue of Canadian Birds, embracing in part the observations of Mr. William Spreadborough and Mr. Geo. Atkinson on many species occurring in the Edmonton district. To these gentlemen I feel indebted. My thanks are due to Mr. P. A. Taverner, who kindly assisted in matters of nomenclature and identification.

Western Grebe (*Æchmophorus occidentalis*).—Observed occasionally during the fall.

Horned Grebe (*Colymbus auritus*).—Common summer resident. Breeds; nests from June 5 to 25.

Pied-billed Grebe (*Podilymbus podiceps*).—This species was reported at Edmonton, in 1906, by Geo. Atkinson.

HERRING GULL (*Larus argentatus*).—Very common during the spring and early summer. There is yet some doubt as to the specific identity of the large gull of the *argentatus* type which frequents the prairie provinces and north-westwards to Edmonton. Presumably this reference should belong under *californicus*.

FRANKLIN ROSY GULL (*Larus franklinii*).—Very common usually during the latter part of June and early July.

BLACK TERN (*Hydrochelidon nigra surinamensis*).—Abundant breeder about the sloughs. Arrives about May 20. Nests early in June; the young are born about June 26, and take to the water by July 14.

AMERICAN WHITE PELICAN (*Pelecanus erythrorhynchos*).—In all probability may be expected in the Edmonton district as Wm. Spreadborough records them breeding on Lake Ste. Anne, north-west of Edmonton, in 1898.

MALLARD (*Anas boschas*).—Occasionally noted during the spring and fall. A few may breed as Mr. Spreadborough found a nest on June 7, 1897. Changing conditions due to much recent settlement of the country may have its influence on the wilder breeding water fowl, forcing them back to more remote localities.

GADWELL (*Chaulelasmus streperus*).—Breeds in limited numbers. Arrives about May 10. Young nearly full grown by August 1.

AMERICAN WIDGEON OR BALDPATE (*Mareca americana*).—Mr. Spreadborough reports this species as common at Edmonton in 1897, a few arriving as early as April 17. By May 5, but not until then, were they common. They were breeding at that time.

GREEN-WINGED TEAL (*Nettion carolinensis*).—Tolerably common. Breeds. Arrives about May 5. I have observed individuals on the White-mud river as late as November 1.

BLUE-WINGED TEAL (*Querquedula discors*).—Common. Breeds. Arrives about May 1.

SHOVELLER OR SPOON-BILL (*Spatula clypeata*).—Frequently observed during the spring and fall migrations.

REDHEAD (*Marila americana*).—Mr. Spreadborough collected a male at Edmonton on May 18, 1897.

CANVAS-BACK DUCK (*Marila vallisneria*).—Common during spring and fall. Breeds sparingly.

AMERICAN SCAUP DUCK (*Marila marila*).—Noted during the spring migrations.

AMERICAN GOLDEN-EYE (*Clangula clangula americana*).—The first water fowl to arrive in the spring, which is about April 6. Does not breed in the vicinity.

BUFFLE-HEAD (*Charitonetta albeola*).—Rather uncommon. Occasionally observed in May and August.

WHITE-WINGED SCOTER (*Oidemia deglandi*).—Mr. Spreadborough reported this species as common at Lake Ste. Anne on June 9, 1898, not far from Edmonton.

RUDDY DUCK (*Erismatura jamaicensis*).—Fairly common in spring. Arrives about May 1. Apparently does not breed in the vicinity.

CANADA GOOSE (*Branta canadensis*).—Migrants observed in spring about May 10.

AMERICAN BITTERN (*Botaurus lentiginosus*).—Common breeder about all the sloughs.

CAROLINA RAIL (*Porzana carolina*).—Fairly common summer resident. On November 10, 1912, I found an individual with a fractured wing-bone, frequenting an open spring.

AMERICAN COOT (*Fulica americana*).—The most common breeding water-fowl at Edmonton. Arrives about May 1; nests May 20, eight to eleven eggs to the clutch; young born about June 6.

NORTHERN PHALAROPE (*Phalaropus lobatus*).—Mr. Atkinson noted this species at Edmonton, August, 1906.

WILSON PHALAROPE (*Steganopus tricolor*).—A female was taken by Mr. Spreadborough, at Edmonton, on May 26, 1897.

WILSON SNIPE (*Gallinago delicata*).—Uncommon. Evidently does not breed in the vicinity.

DOWITCHER (*Macrorhamphus griseus*).—Mr. Spreadborough collected both the male and the female at Edmonton, on May 3, 1897. These are undoubtedly the Long-billed *scolopaceus*.

PECTORAL SANDPIPER (*Pisobia maculata*).—Reported by Mr. Atkinson as abundant after August 6, 1906.

LEAST SANDPIPER (*Pisobia minutilla*).—Rather uncommon; individuals observed as late as July.

SANDERLING (*Calidris arenaria*).—Noted in considerable numbers by Mr. Atkinson, between Saskatoon and Edmonton, in 1906.

MARBLED GODWIT (*Limosa fedoa*).—Noted as far west as Edmonton, in 1906, by Mr. Atkinson.

GREATER YELLOW-LEGS (*Totanus melanoleucus*).— Occurs as a migrant.

LESSER YELLOW-LEGS (*Totanus flavipes*).—Usually a few flocks observed about April 25. They may breed, as I have observed them as late as July.

SOLITARY SANDPIPER (*Helodromas solitarius*).—During the spring of 1897, Mr. Spreadborough saw numbers at Edmonton. He believes they breed.

WILLET (*Symphemia semipalmata*).—A male bird was collected by Mr. Spreadborough on May 5, 1897. Presumably this is referable to *inornata*.

BLACK-BELLIED PLOVER (*Squatarola squatarola*).—Mr. Spreadborough took a female on May 21, 1897.

AMERICAN GOLDEN PLOVER (*Charadrius dominicus*).—A male was taken by Mr. Spreadborough on May 20, 1897.

KILDEER PLOVER (*Oxyechus vocifera*).—Common breeder. Arrives about April 15.

SEMIPALMATED PLOVER (*Ægialitis semipalmata*).—I have only one record, a flock seen on May 13, 1912, feeding along the margin of a pond.

RUFFED GROUSE (*Bonasa umbellus*).—Common permanent resident. This form is probably referable to *umbelloides*.

SHARP-TAILED GROUSE (*Pedioecetes phasianellus*).—Common permanent resident. No doubt referable to the sub-specific form *campestris* as Mr. Atkinson recorded it as far west as Edmonton, in 1906. Mr. Spreadborough, in 1897, also, observed individuals as far as twenty-five miles west of that place.

MARSH HAWK (*Circus hudsonius*).—Common summer resident. Breeds.

AMERICAN GOSHAWK (*Accipiter atricapillus*).—Occasionally observed. More common further west.

RED-TAILED HAWK (*Buteo borealis*).—Not uncommon. Nests along the Saskatchewan river. "The form occurring here is no doubt referable to sub-species *Calurus*."—(P. A. Taverner).

SWAINSON HAWK (*Buteo swainsoni*).—Mr. Spreadborough collected a female at Edmonton on May 6, 1897.

AMERICAN ROUGH-LEGGED HAWK (*Archibuteo lagopus sanctijohannis*).—Mr. Spreadborough observed a bird of this species at Edmonton in April of 1897.

PIGEON HAWK (*Falco columbarius*).—Macoun's Catalogue states that Mr. Spreadborough found this species nesting at Edmonton in 1897. Mr. Taverner informs me that it is not quite clear whether Spreadborough recognized both forms of Pigeon Hawk. All his specimens in the Geological Survey collection are typical *richardsonii*.

RICHARDSON MERLIN (*Falco richardsonii*).—Taken on different occasions by Mr. Spreadborough during the spring of 1897.

AMERICAN SPARROW HAWK (*Falco sparverius*).—Fairly common. Breeds.

LONG-EARED OWL (*Asio wilsonianus*).—A female was collected by Mr. Spreadborough on May 15, 1897. He found it nesting in spruce woods.

SHORT-EARED OWL (*Asio accipitrinus*).—A few individuals were observed by Mr. Spreadborough during May, 1897.

SAW-WHET OWL (*Cryptoglaux acadica*).—I only observed two individuals of this little owl. Mr. Spreadborough records it in the spring of 1897.

GREAT HORNED OWL (*Bubo virginianus*).—Not uncommon. Many each fall are shot and taken to taxidermists. I think *subarcticus* occurs as I have seen very light colored birds; *pallescens,* too, may occur as a straggler, and *saturatus* as a winter migrant, but I have not had material for exact sub-specific comparison.

BELTED KINGFISHER (*Ceryle alcyon*).—Breeds along the Saskatchewan and White-mud rivers.

HAIRY WOODPECKER (*Dryobates villosus*).—Reported as occuring at Edmonton by Mr. Spreadborough. Records by Mr. Atkinson and Mr. Spreadborough also refer many of the specimens to *leucomelas.* I found them nesting on May 12, 1912.

DOWNY WOODPECKER (*Dryobates pubescens medianus*).—More common during spring and summer than during winter. Mr. Spreadborough found them rather rare in 1897, but they were common during the spring and summer of 1912 and 1913.

ARCTIC THREE-TOED WOODPECKER (*Picoides arcticus*).—Collected one specimen among the spruces along the Saskatchewan river on February 21, 1913. The only individual observed there.

YELLOW-BELLIED SAPSUCKER (*Sphyrapicus varius*).—Common summer resident. Arrives early in May.

NORTHERN FLICKER (*Colaptes auratus luteus*).—Common summer resident. Arrives about April 21.

RED-SHAFTED FLICKER (*Colaptes cafer*).—I saw a mounted specimen of this species in the city, but failed to make inquiries as to where it was taken. It is probable that this or the hybrid flicker may occur in the Edmonton district. Mr. Taverner informs me that he found a strong infusion of *cafer* among the specimens he took at Red Deer, Alta., during the summer of 1917.

NIGHT HAWK (*Chordeiles virginianus*).—Common summer resident. Arrives about May 28.

CHIMNEY SWIFT (*Chaetura pelagica*).—Mr. Spreadborough noted two individuals at Edmonton on May 17, 1897.

KINGBIRD (*Tyrannus tyrannus*).—Common summer resident. Arrives about May 24. Nest completed and full set of eggs by June 20.

PHOEBE (*Sayornis phoebe*).—Not very common. Arrives early in May.

SAY PHOEBE (*Sayornis saya*).—Observed by Mr. Spreadborborough in 1897. He collected two females, one on May 5, the other on May 7.

WESTERN WOOD PEWEE (*Myiochanes richardsonii*).—Mr. Spreadborough collected a male on June 2, 1897.

TRAILL FLYCATCHER (*Empidonax traillii*).—This form was met with by Mr. Spreadborough at Edmonton in 1897. First seen May 26, common by June 2. This bird is no doubt referable to the

sub-specific form *alnorum.*

LEAST FLYCATCHER (*Empidonax minimus*).—By far the commonest flycatcher at Edmonton. It may always be heard uttering its unmusical *che-bec* wherever the usual poplar forest exists. They arrive by May 16 and in two days are common. It is probable that the males preceed the other sex by that much time. Their nest is a marvel of beauty and skill, and is usually completed and the full compliment of eggs laid by June 6.

HORNED LARK (*Otocoris alpestris*).—Apparently rare at Edmonton. According to my notes only once heard or seen, namely on March 25, 1913. The breeding form at Edmonton is possibly *leucomelas,* though *alpestris* and *hoyti* may also occur in migration.

BLUE JAY (*Cyanocitta cristata*).—Uncommon. Occasionally seen along the rivers in the heavier growth.

CANADA JAY (*Perisoreus canadensis*).—Mr. Spreadborough found this species in the Edmonton district in 1897. During 1912-13-14 I never once saw this bird, although it is very common in the foot-hill and mountain country to the west, where I saw it during the fall of 1913. I am informed by Mr. Taverner that Mr. H. C. Oberholser has determined Spreadborough's specimens as the type form *canadensis.*

AMERICAN CROW (*Corvus brachyrhynchus*).—Common summer resident. Arrives about April 1. Geographically this form should be the western crow *hesperis.*

COW BIRD (*Molothrus ater*).—Common summer resident. Arrives May 16. On June 13, 1913, I found an egg belonging to this bird in the nest of a Yellow Warbler.

YELLOW-HEADED BLACKBIRD (*Xanthocephalus xanthocephalus*). Common summer resident. Nests in the same localities with the redwing.

REDWINGED BLACKBIRD (*Agelaius phoeniceus*).—Very common summer resident. Arrives about April 25. The form inhabitating the prairies and the far north has been, in the past, referred to *A. p. fortis.* Mr. Oberholser has since sub-specifically referred it to *arctolegus.*

WESTERN MEADOW LARK (*Sturnella neglecta*).—Cannot be called common. Arrives about May 17. The song of this species is quite distinct from the eastern meadow lark. Mr. Taverner informs me that it is now given full specific standing.

BALTIMORE ORIOLE (*Icterus galbula*).—Breeds at Edmonton but is not plentiful. Arrives May 20.

RUSTY BLACKBIRD (*Euphagus carolinus*).—Very abundant breeder. Arrives about April 10. I once saw a single individual among the rushes of a frozen marsh, on November 25.

(*To be continued*).

ON THE GENUS TRACHODON OF LEIDY[1].

By LAWRENCE M. LAMBE, F.R.S.C.
Vertebrate Palæontologist, Geological Survey, Canada.

The generic term *Trachodon* first appeared in palæontological literature in 1856[2] when Dr. Joseph Leidy used it in describing teeth and tooth-fragments of herbivorous dinosaurs under the name *T. mirabilis.* These teeth were discovered by Dr. F. V. Hayden in the "bad lands" of Judith river, Montana (then included in Nebraska), U.S.A., in deposits which are now generally regarded as synchronous, or nearly so, with the Belly River formation of Alberta, Canada. This was the first descriptive reference to remains of the North American Cretaceous herbivorous dinosaurs which have since been usually referred to as constituting the family *Hadrosauridae* (*Trachodontidae*) related to the *Iguanodontidae* of Europe, the two families being classed under the suborder *Ornithopoda* of the *Predentata.*

The identification of this genus is rendered uncertain by the paucity of material on which it was established.

Following the description of *Trachodon* in 1856, Leidy in the same year described two caudal vertebræ and a phalanx of a dinosaur from the "Lignite formation of Grand river, Nebraska," (Lance formation) under the name *Thespesius occidentalis.*

This genus rests on as unsatisfactory a basis as *Trachodon* as inferences drawn from the type material, which in this case as in *Trachodon* must be considered inadequate, have too great an element of conjecture.

The third genus, and the first to be founded on fairly comprehensive material was *Hadrosaurus,* established by Leidy in 1858 on remains from the Cretaceous marls near Haddonfield, New Jersey. That *Hadrosaurus,* of which many bones of the skeleton as well as teeth from both jaws, presumably of one individual, are known, is not generically the same as *Trachodon* is most probable when we compare the teeth of the former having papillated margins and a rounded apex, with the smooth margined, sharply pointed tooth of the latter.

In 1860[3] Leidy described the Judith river teeth at greater length with good illustrations. Of the six teeth figured, two are nearly complete, the other four are fragmentary. The tooth first mentioned in the description (figures 1—6) is that of a hadrosaur. The last one (figures 18—20) belongs to a ceratopsian, and three of the four fragmentary ones are probably assignable to the *Hadrosauridae.*

The close affinity of *Trachodon,* as represented by the meagre

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[1]Communicated with the permission of the Deputy Minister of Mines.
[2]Proc. Acad. Nat. Sci. Phila., vol. VIII, p. 72.
[3]Trans. Am. Phil. Soc. vol. XI, pp. 140-143, pl. 9, figs. 1-20.

material above mentioned, to *Hadrosaurus* was recognized[4] by Leidy, who also suspected that the ceratopsian tooth which he had included in the description of *Trachodon mirabilis* might not properly belong there[5]. He suggested that the best preserved tooth originally referred to *Trachodon* might be included with *Hadrosaurus,* reserving for the ceratopsian tooth the generic term *Trachodon.* If this suggestion were acted on *Trachodon* would necessarily become a genus of horned-dinosaur. The term *Trachodon,* however, has passed extensively into the literature of the North American dinosaurs in connection with bipedal, herbivorous Cretaceous forms and, if retained as a name denoting a genus, had best remain with this association. Unfortunately it has been used for the reception of inadequately represented and imperfectly understood diverse forms of these dinosaurs from different horizons of the Cretaceous.

The tooth of *Trachodon,* first mentioned in Leidy's original description, and later figured first in his plate of illustrations and referred to as being the most important of the specimens should be considered the type of the genus. On the characters of this tooth, therefore, must the validity of the genus *Trachodon* rest. The tooth is from the lower jaw, and if the figure illustrating it be correct, and there is every reason for believing it so, it is very pointed above. As regards the lithographic illustrations of Dr. Leidy's paper of 1860 in the Transactions of the American Philosophical Society, vol. XV., their artistic merit is so pronounced, and all the figures of the three large plates have so much the appearance of being accurate portrayals of the fossils themselves that it appears reasonable to assume that the type tooth of *T. mirabilis* is not shown too pointed at the apex.

Since the days of this pioneer work many new forms of hadrosaur dinosaurs have been described from excellent and wonderfully complete material collected in the Cretaceous of the west both in Canada and the United States, particularly in recent years from the Belly River and Edmonton formations of Alberta. In none of the Belly River genera best known from unusually perfect skulls, such as *Stephanosaurus* Lambe, *Gryposaurus* Lambe, and *Prosaurolophus* Brown, are the teeth acutely pointed as in *Trachodon* Leidy. It is necessary, therefore, to conclude that the genus *Trachodon* is as yet unknown in the Belly River, and fully or partially synchronous formations, except from this single mandibular tooth. Nor is this genus recognizable in the Edmonton and Lance formations, or their equivalents, of the later Cretaceous, in such forms, known from nearly perfect skulls, as *Diclonius* Cope, *"Claosaurus"* Marsh, *Saurolophus*

[4]Smith. Contr. Know. vol. XIV, p. 84, 1865.
[5]Remarks on a jaw fragment of Megalosaurus, by Joseph Leidy, M.D., Proc. Acad. Nat. Sci. Phila., vol. XX, p. 199, 1868.

Brown, *Cheneosaurus* Lambe, and *Edmontosaurus* Lambe. In fact a smooth margined normally shaped tooth as pointed as the type of *Trachodon* is not found in any of the above mentioned genera of Belly River and later Cretaceous times. If the name *Trachodon* is to be retained it can only be regarded as denoting a genus based on a tooth supplyng as yet insufficient diagnostic characters. If the tooth is normal in shape the genus it represents is not recognizable among the many forms now known from comprehensive and well preserved material. If the tooth is abnormal it has little or no value from a palæontological standpoint and the name *Trachodon* had best be discontinued in use.

As a result of the variety of hadrosaurs discovered of late years, principally in the Cretaceous of Alberta, Canada, we now have accurate knowledge of many genera displaying a wonderful variance in cranial development in crested and non-crested forms from *Stephanosaurus,* with a skull higher than long, to *Diclonius* with a lengthened and very depressed head.

Hatcher in 1902[6] in a paper on the genera and species of *Trachodontidae,* expressed the opinion that two genera only, *Trachodon* Leidy and *Claosaurus* Marsh (represented by *C. agilis*), should be retained of the many proposed prior to 1892. That many of the genera and species referred to in his paper are founded on insufficient material is obvious. The many discoveries of late years of crested and non-crested types make it desirable that a thorough revision of the family should be now undertaken.

As regards the name of the family, for the reception of the various genera of North American Cretaceous bipedal, herbivorous dinosaurs, the term *Hadrosauridae* was proposed by Cope in 1869[7]. (1871), and has precedence to *Trachodontidae* used by Lydekker in 1888[8], and later by Marsh in 1890[9]. Quite apart from any question of precedence the name *Hadrosauridae* is much to be preferred of the two when we consider the material on which the genera *Trachodon* and *Hadrosaurus* are founded. The characters of *Trachodon* are unknown beyond those of the single mandibular tooth constituting the type, although many have been assigned to it for whch there is no warrant. The material on which *Hadrosaurus* rests includes a number of cervical, dorsal, and caudal vertebræ, the principal bones of the fore and hind limbs, an ilium, an ischium, a portion of a dentary bone, and a number of both upper and lower teeth; unfortunately the cranium is not represented.

[6]The genera and species of the Trachodontidae (Hadrosauridae, Claosauridae) Marsh. Annals of the Carnegie Museum, vol. I, pp. 377-386.

[7]The extinct Batrachia, Reptilia, and Aves of North America, Trans. Am. Philos. Soc. vol. XIV; new series, 1871, p. 91.

[8]Cat. of fossil Reptilia and Amphibia in Brit. Mus., pt. I, 1888, p. 241.

[9]Additional characters of the Ceratopsidae, with notice of new Cretaceous dinosaurs. Am. Journ. Sci., third series, vol. XXXIX, 1890, p. 424.

The *Hadrosauridae* appear to fall into two natural groups or subfamilies, the crested forms with a "footed" ischium, and the non-crested ones having an ischium ending distally in a point. For these subfamilies the names *Saurolophinae* and *Trachodontinae* respectively were proposed by Brown in 1914. *Saurolophinae,* typified by *Saurolophus* Brown, fully meets all requirements as a group-name. *Trachodontinae* on account of the dubiousness of the genus *Trachodon* fails in this regard, and *Hadrosaurinae* is suggested as a preferable term. The genus *Hadrosaurus* was most probably a non-crested form, reliance being placed on the evidently pointed termination of its ischium. It is impossible to state whether *Trachodon* was a crested or non-crested form.

Adopting these subdivisions of the *Hadrosauridae,* the genera of which the structure of the head is best known may be grouped as follows, with the earlier types of the Belly River formation first:—

HADROSAURINÆ.	SAUROLOPHINÆ.
Gryposaurus Lambe, Belly River.	*Stephanosaurus* Lambe, Belly River.
Edmontosaurus Lambe, Edmonton.	*Prosaurolophus* Brown, Belly River.
Kritosaurus Brown, Horizon uncertain?=Edmonton.	*Corythosaurues* Brown, Belly River.
"*Claosauous*" Marsh, Lance.	*Saurolophus* Brown, Edmonton.
Diclonius Cope, Lance.	*Cheneosaurus* Lambe, Edmonton

Hypacrosaurus Brown is a genus from the Edmonton formation of Alberta. It's skull, as yet unknown, will probably be found to be crested as the ischium is expanded distally into a "foot." Like *Hadrosaurus* its assignment to a subfamily depends at present on the shape of the ischium. *Hypacrosaurus* is stated by Brown to also occur in the Belly River formation of Alberta.

The complete skeleton of a large hadrosaur from the Lance formation of Dakota, now mounted in the American Museum of Natural History, New York, and referred to generally as *Diclonius mirabilis,* was described by Cope, under this name, in 1883, with special reference to the cranial characters.

Cope identified this Lance species with *Trachodon mirabilis* of the Judith River beds, substituting the name *Diclonius* for *Trachodon* on the supposition that the latter had been abandoned by Leidy. Cope, prior to this, had described three species of *Diclonius*—*D. pentagonus, D. perangulatus,* and *D. calamarius*—without figures, from shed teeth from the Judith River formation, which teeth are stated to be no longer identifiable in the Cope collection. It would seem to be best, therefore, in the interests of palæontology, to discontinue the use of these three specific names.

Although a comparison of *Trachodon mirabilis* Leidy, (represented by a single tooth) with *Diclonius mirabilis* Cope, (known from the complete skeleton) is necessarily limited, it is clear that the two forms are not conspecific, the pointed tooth of the former differing in a marked degree from the teeth of the latter with apices rounded in lateral outline as figured by Cope. It is difficult, if not impossible, to arrive at any conclusion regarding their generic relationship, but it is highly probable, in view of their difference in geological age, that they are not congeneric. It is considered best, therefore, under the circumstances, to retain the generic term *Diclonius* in association with the Lance species which has been so long known to palæontologists generally as *Diclonius mirabilis* of Cope.

The genus *Claosaurus* was established by Marsh in 1890 on the remains of a small hadrosaur, from the Niobrara of Kansas, which had been described by him in 1872 under the name *Hadrosaurus agilis*. There were available for comparison the more important portions of the skeleton, but no parts of the skull except teeth were obtained. To this genus Marsh later assigned a species, from the Lance formation of Wyoming, which he described, from comprehensive material (including the skull) as *C. annectens*.

That Marsh was wrong in referring his Wyoming species to so early a genus as *Claosaurus* is most probable. That the species belongs to the genus *Hadrosaurus* is unlikely. The genus *Trachodon*, to which this species is sometimes assigned, is not definable and therefore cannot be properly used for its reception.

The species *annectens* of Marsh comes under the sub-family *Hadrosaurinae* and probably belongs to an unnamed genus. For the purpose, however, of this paper the generic term *Claosaurus* is made use of to receive it.

Dr. C. W. Gilmore, writing in 1910[10] on the genus *Trachodon*, concludes, in part, that "the use of the term *Trachodon* should be restricted in its application to some one of the trachodonts found in the older beds" (Belly River, Judith River, etc.). To which then of the several at present known Belly River genera could the term *Trachodon* be applied?

BRIEF NOTES ON THE PREVALENCE OF CERTAIN BIRDS IN BRITISH COLUMBIA.

BY ALLEN BROOKS,

Major, British Expeditionary Force, France.

Band-tailed Pigeons (*Columbia fasciata* Say)—Very few of these are killed in B. C. The depletion must come in their winter quarters.

[10]Science, new series, vol. XLI, p. 658.

Cranes and Swans—These birds suffer in their breeding haunts in the far north. Few are killed after they migrate. Both must have conditions where they are not much disturbed when at rest; large bodies of water free from pleasure craft for swans and large open plains for cranes. They mostly now pass over their former winter quarters and those they used on migrations formerly, as they are too much disturbed. Protection will not change this.

Long Billed Curlew (*Numenius americanus* Wies.) are bound to decrease and perhaps disappear. Their favourite breeding grounds now are summer-fallows and cultivation destroys most of their nests. Crows and coyotes also get their eggs and young. Nobody shoots them in B. C.

Hudsonian Curlew (*Numenius hudsonicus* Lath.)—Plentiful all along the Pacific coast. Only pass through B. C. in spring and fall—mostly in May. Nobody shoots them.

Eskimo Curlew (*Numenius borealis* Forse).—The disappearance of this bird like that of the Labrador duck and passenger pigeon will always be an unexplained mystery.

Wood Duck (*Aix sponsa* L.)—Still plentiful where the proper breeding conditions exist. It is bound to disappear from the east where the big timber is cut away and the woodland ponds and streams dry up.

The commonest goose in B. C. is Hutchins goose (*Branta canadensis hutchinsi* Rich.)—Practically all of these pass through between 1st October and 25th November and again from 10th April to 20th May.

Ducks.—Canvas backs, Redheads, and scaups or blue-bills are all increasing in the interior of B. C. where they are good game ducks. This is probably due to the increase of duck weed in the larger lakes. The bulk arrive in from the south late in January in Okanagan and get extraordinarily far. Few are shot in comparison to the thousands that come north.

Up to March 1st the proportion of males to females in all ducks except Mallards is about 3 to 1. In the Mallard the proportion of the sexes is the same the year around. In California and Mexico the females of most ducks are in excess. Mating with most ducks commences about 1st March in our province.

Grouse.—All grouse are practically permanent residents wherever found and should have plenty of protection. Make open season short and bag limit small. First October should be early enough for open season to start. Bag limit eight of any one species per day. They

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EDITORIAL NOTE:—The above notes are taken from a valuable letter dated August 19, 1917, which I received from Major Brooks in reply to a request for his opinion on a number of points in connection with the Regulations under the Migratory Birds' Convention Act.—C.G.H.

suffer from the weather and also many parasitic diseases, and greatly from depredations of crows and magpies. In Okanagan these get nearly all the first layings of Prairie chickens, while the herbage is still short.

THE FUR SEALS*

Although the natives of the Aleutian Islands have a tradition that fur-seals once bred there, no fur-seal remains or other facts have been discovered which warrant the belief that they ever came ashore anywhere else in the North Pacific except on the Commander and Pribiloff groups of islands or on a few small islands and reefs in Japanese waters, where they were undisturbed by man, for when discovered all the breeding places of the fur-seals were on islands which showed no evidence of ever having been visited by even aboriginal man.

Both the main groups of breeding islands, although many hundreds of miles apart, are washed by the waters of the warm Japanese Current, and that part of Bering Sea is for several months in the summer almost continually drenched with fog, many weeks sometimes passing without a glimpse of the sun. On these foggy beaches and along the bases of cliffs the fur-seals breed in literally countless thousands, as many as 4,000,000 having been estimated as being on the Pribiloff islands in a single season; indeed Lieut. Maynard, who visited the islands for the U.S. Government in 1872, estimated the total number in that year to be nearly 6,000,000. These figures are greatly overestimated as when actual counts of the seals were made in later years, the numbers were found to be much less than anyone would have believed from simply looking at them, although in 1897, after many years of destructive killing, there were still nearly a million seals on the islands of St. Paul and St. George. Whatever the greatest number may have been at any particular time, the records show that up to 1889 there had been actually shipped no less than 4,439,000 skins of young male fur-seals.

There can be no doubt that with the adequate protection that is now being given the fur-seals, both at sea and on land, they will ultimately increase to their former numbers. In 1914, nearly 300,000 seals were estimated as being on the islands, and the present rate of annual increase is over 15 per cent. This percentage will increase as conditions become more nearly normal.

Following a brief historical statement of the Bering Sea Fur Seal controversy, Mr. Macoun showed an instructive series of lantern

*From a lecture on The Fur-Seals, by Mr. James M. Macoun, C.M.G., before the O.F.N. Club, March 5, 1918.

slides, and gave interesting facts regarding the habits and life-history of the seals.

When the Russians first visited the seal islands descriptive words were coined for animals of the two sexes and various ages. The breeding males were called "old bulls"; the females, "cows"; the non-breeding males, "holluschickie" or bachelors; and the young seals "pups." The old bulls live to a considerable age and attain great size, animals weighing 600 pounds or over being not uncommon. The cows are much smaller, seldom weighing more than 100 pounds. The males reach maturity when six or seven years old, the females the second year. Seals are polygamous animals, each male gathering around him as many females as he can secure. The average size of the harems, as they are called, was in 1914 sixty. As the sexes are born in about equal numbers, it is evident that a very considerable percentage of the male life may be taken without injury to the main herd providing a sufficient surplus is left to furnish scope for the working out of natural selection.

While the fur-seals are born on the land their natural element, of course, is the water and there they spend the greater part of their lives and secure their food. At the present time the fur-seals which go in the summer to the Pribiloff and Commander islands are distributed over the North Pacific Ocean south of the Aleutian Islands, the main body of the so-called American herd living off the coasts of Washington, Vancouver Island and southern Alaska, but even when their numbers were greater not many were seen from ships. The distribution depends chiefly, of course, on the food supply, which is made up chiefly of surface fishes and squid. They have frequently been found as far south as San Francisco. When pelagic sealing was at its height the schooners left Victoria and other ports about the month of March or later, the date of sailing depending upon the willingness of the hunters and boatmen to brave the storms of winter and early spring. As the seals moved north they approached the coast, one of the favorite hunting grounds being just north of Sitka where they were found in large numbers. Following the coast north and west and travelling quickly from one feeding ground to another the first seals reach the Pribiloff Islands towards the end of April, the adult females and older bachelors arrive there early in June, the two-year-olds mainly in July and the yearlings in the latter part of August and September. While on the islands the old bulls do not feed at all. In fact from the day they arrive and take up the station of their choice they neither eat nor drink until they return to the sea in September or later. During this time they not only take part in continual fights but exercise an almost perfect control over their harems, no "cow" being allowed to leave until she has been fertilized. The "cows" do not usually come ashore until they are about to give birth to their

young, which are dependent upon their mothers until the autumn, when they leave the islands with the other seals and fend for themselves. The young fur-seals cannot swim at birth and do not venture into the water until they are a month or six weeks old. As the young male seals do not go on the breeding rookeries but "haul out" by themselves they can be driven to the killing-grounds without disturbing the breeding seals and it is only these young males that are now killed.

REVIEW.

FLORA OF THE ROCKY MOUNTAINS AND ADJACENT PLAINS, containing descriptions of the native and naturalized flowering plants and fernworts, growing in COLORADO, UTAH, WYOMING, IDAHO, MONTANA, SASKATCHEWAN, ALBERTA, and the neighboring parts of NEBRASKA, SOUTH DAKOTA, NORTH DAKOTA and BRITISH COLUMBIA, by P. A. Rydeberg, Ph.D., Curator, New York Botanical Garden. Published by the author. Price $4.05 post free.

At any time during the last half-century the more eastern American botanists have had a handbook or manual by which the could identify the species they collected, but it was not until quite recent years that western botanists had such helps to the study of plants, and the Canadian botanist resident between Manitoba and British Columbia was until a few months ago without a worth-while book of any kind. Even the professional botanist with access to a good library was never certain that the species before him had not been described or re-described in some obscure periodical or list that was unknown to him. The average amateur botanist could do nothing but send his difficult species to some large herbarium for determination. Dr. Rydeberg's fine book has changed all this and the fact that it was primarily intended for the United States makes it all the more valuable to Canadian botanists. A flora restricted to the species known to occur in Canada would have left the Canadian botanist without descriptions of scores of species which undoubtedly grow in western Canada but have not yet been recorded. Indeed the writer during the short time he has used the book has noted in the herbarium of the Geological Survey several species that had not been separated from closely allied ones, and of course he will find many others.

Dr. Rydeberg has been studying the flora of the Rocky Mountain region for more than twenty-five years both in the field and in the herbarium and in the 1110 pages of his Flora he describes 1038 genera and 5897 species of plants. Keys to families, genera and species, make a study of the descriptions unnecessary in the great majority of

cases and while not attempting to label all the species with English names they are given for all genera and for most of the more widely distributed species.

All Canadian botanists owe a great debt to Dr. Rydeberg for having so widened the scope of his flora that few plants will be found in western Canada, east of the Selkirk Mountains and south of the Arctic Circle, that are not described in it, for while he fixed on Lat. 56° as the northern limit of the territory covered by his book this takes the collector north of the prairie country to regions where the ordinary woodland species predominate, and in the Rocky Mountains north of Lat. 56° the flora does not differ greatly from that of the mountains further south except that the number of species is smaller. It was too much to expect that all the species known to occur in Canada between Manitoba and British Columbia should have been credited to the Dominion by one who had to some extent to depend upon others when recording the range of species, but the omissions are surprisingly few and with rare exceptions these species will be found recorded from adjacent Dakota or Montana. Local botanists in Saskatchewan and Alberta cannot do better than compile from Dr. Rydberg's Flora lists of the species recorded there from these provinces, and working from these lists additions should be recorded as found.

The writer regrets, and most Canadian botanists will agree with him, that the nomenclature used by Dr. Rydberg is not that used by Canadian government botanists who follow as closely as possible the so-called Vienna Rules. The names used in Dr. Rydberg's Flora are for the most part those called for by the "American Code" and the names of many of the commonest species will appear strange to those who have been using Gray's Manual, the book upon which most non-professional Canadian botanists, even in the prairie country, depend for the knowledge of Canadian species. Dr. Rydberg has, it is true, included in the synonymy, in most cases, the name by which species should be called under the Vienna Rules but as there is nothing to distinguish such synonyms from others the student who is working without other books must for the time at least adopt Dr. Rydberg's names. Not many Canadian botanists either will care to follow Dr. Rydberg in his sub-divisions of genera but this is more or less a matter of individual judgment and taste. Many who are willing to separate *Pulsatilla* from *Anemone* or *Atragene* from *Clematis* will balk at breaking up *Saxifraga* into eight or more genera or *Habenaria* into five. Just now, however, questions of nomenclature are of minor importance compared with the collection and study of plants and there can be no doubt that the publication of Dr. Rydberg's Flora will give a great impetus to the study of botany in western Canada.

J. M. M.

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THE BIRDS OF EDMONTON.

By J. Dewey Soper, Preston, Ont.

(Continued from page 134).

Brewer Blackbird (*Euphagus cyanocephalus*).—Fairly common summer resident. Nest and eggs complete are found usually by May 10.

Bronzed Grackle (*Quiscalus quiscula*).—A number breed around Edmonton. Arrives April 25. This form is sub-specifically referable to *Q. q. aeneus.*

Evening Grosbeak (*Hesperiphona vespertina*).—I saw these birds during the spring only of 1913. The first flock of seven were seen on the morning of April 17. Further numbers were observed at various times until May 10, when they then disappeared.

Pine Grosbeak (*Pinicola enucleator*).—Usually a common winter visitor; sub-specifically *leucura* on geographical probability.

Purple Finch (*Carpodacus purpureus*).—This beautiful singer is first heard about May 15, when it may be seen singing from the topmost crest of a tall spruce or to launch on fluttering wings to deliver its melody high in the air. It nests at Edmonton.

American Crossbill (*Loxia curvirostra minor*).—Recorded by Mr. Atkinson, in 1906, at Edmonton.

Redpoll (*Acanthis linaria*).—Usually very common during the winter, much more so during the first two weeks in April. after which they disappear.

American Goldfinch (*Astragalinus tristis*).—This handsome bird is tolerably common during the summer but does not arrive until about June 1.

Pine Siskin (*Spinus pinus*).—Mr. Spreadborough found them at Edmonton in 1897.

Snowflake (*Passerina nivalis*).—Numerous throughout the winter.

Lapland Longspur (*Calcarius lapponicus*)—Mr. Spreadborough found them abundant as a migrant from April 28 to May 5, 1897.

CHESTNUT-COLLARED LONGSPUR (*Calcarius ornatus*).—Mr. Atkinson records this species at Edmonton in 1906.

VESPER SPARROW (*Poocoetes gramineus*).—Not common. Arrives about May 10. Presumably the sub-specific form *confinis*.

SAVANNA SPARROW (*Passerculus sandwichensis*).—Abundant. Arrives about May 1. Referable to sub-specific form *alaudinus*.

BAIRD SPARROW (*Centronyx bairdii*).—Mr. Atkinson recorded it as numerous in grass marshes in the year 1906.

LECONTE SPARROW (*Ammodramus leconteii*).—A single sparrow which I refer to this species was observed on May 11, 1913, frequenting a tract of low scrub willows. Mr. Spreadborough took a male on May 26, 1897.

NELSON SPARROW (*Ammodramus nelsoni*).—Mr. Spreadborough first saw this species late in May, 1897. It was uncommon, and breeding in wet ground.

WHITE-CROWNED SPARROW (*Zonotrichia leucophrys*).—A number of migrants are annually observed from about May 10 to 20. The sub-species *gambeli* no doubt occurs regularly with the typical form as Mr. Taverner informs me there is a specimen in the Victoria Museum taken at Edmonton in 1897.

WHITE-THROATED SPARROW (*Zonotrichia albicollis*).—Fairly common summer resident. First observed about May 12.

TREE SPARROW (*Spizella monticola*).—Very abundant during the forepart of April, 1912, and in full song. They remain in flocks and are shy and restless. To my knowledge they do not breed but go further north. Appears again about September 28. This form is referable by geography to the western variety *ochracea*.

CHIPPING SPARROW (*Spizella socialis*).—Common summer resident.

CLAY-COLOURED SPARROW (*Spizella pallida*).—A very common sparrow at Edmonton. First seen about May 16, three days later they are abundant. Nest completed and eggs laid by June 15.

SLATE-COLOURED JUNCO (*Junco hyemalis*).—Common summer resident. Breeds in the river valleys and ravines. Most abundant during the early part of April and early October.

SONG SPARROW (*Melospiza melodia*).—Common summer resident. First observed from April 12 to 20. Nest and clutch of eggs completed by May 25. Mr. Taverner informs me that he determines specimens from Edmonton as *juddi*.

LINCOLN SPARROW (*Melospiza lincolnii*).—The only personal record I have of this species is a single bird observed on May 1, 1912, and a pair the following June 21. Mr. Spreadborough found it abundant at Edmonton in May, 1897.

SWAMP SPARROW (*Melospiza georgiana*).—An abundant breeding species. Arrives early in May.

FOX SPARROW (*Passerella iliaca*).—This wonderful singer is one of the earliest sparrows, appearing about April 14. By May 5, the nest is completed and full set of eggs laid.

ROSE-BREASTED GROSBEAK (*Habia ludoviciana*).—Common summer resident; arriving about April 22.

CLIFF SWALLOW (*Petrochelidon lunifrons*).—Reported as common in Edmonton by Mr. Spreadborough in 1897. Arrived May 13, common by May 21.

BARN SWALLOW (*Hirundo erythrogaster*).—Tolerably common summer resident.

TREE SWALLOW (*Iridoprocne bicolor*).—Common summer resident. First observed about May 12.

BANK SWALLOW (*Riparia riparia*).—A number nest annually in the Saskatchewan river banks.

CEDAR WAXWING (*Ampelis cedrorum*).—Very irregular. Observed several pairs on June 15, 1913.

WHITE-RUMPED SHRIKE (*Lanius ludovicianus*).—Occasionally observed during November and December, 1912. The birds of this region are referable to *excubitorides*. Mr. Spreadborough collected a female of this variety at Edmonton on May 21, 1897.

RED-EYED VIREO (*Vireosylva olivacea*).—Common summer resident. First observed about May 20. Found on June 23, 1913, a nest containing three eggs in a small poplar. The nest was about fifteen feet from the ground.

PHILADELPHIA VIREO (*Vireosylva philadelphica*). — Mr. Spreadborough found numbers breeding at Edmonton in May, 1897.

WARBLING VIREO (*Vireosylva gilva*).—Noted at Edmonton by Mr. Atkinson, in 1906.

SOLITARY OR BLUE-HEADED VIREO (*Lanivireo solitarius*).—Not common. Breeds no doubt as I have seen them in July.

BLACK AND WHITE WARBLER (*Mniotilta varia*).—Rather rare. Remains in the timber near the river.

ORANGE-CROWNED WARBLER (*Helminthophila celata*).—Three males were collected by Mr. Spreadborough on May 5, 7, and 19, respectively, at Edmonton, 1897. These specimens were examined by Mr. Oberholser, two of them determined by him as belonging to the sub-species *orestera* and one to *celata*. (P. A. Taverner).

TENNESSEE WARBLER (*Helminthophila peregrina*).—A male specimen was collected by Mr. Spreadborough on May 22, 1897. He believes they breed at Edmonton.

YELLOW WARBLER (*Dendroica aestiva*).—Common summer resident. Arrives about May 15.

MAGNOLIA WARBLER (*Dendroica maculosa*).—Mr. Spreadborough obtained two males on May 22 and 25, respectively, at Edmonton, 1897.

BLACK-THROATED GREEN WARBLER (*Dendroica virens*).—Tolerably common and breeding in the spruce woods that flank the rivers. First observed about May 16.

OVEN BIRD (*Seiurus aurocapillus*).—Breeds at Edmonton along the timbered river banks. Arrives about May 15, common by the 24th.

GRINNELL WATER-THRUSH (*Seiurus noveboracensis notabilis*). This sub-species was noted as far west as Edmonton, in 1906, by Mr. Atkinson.

MOURNING WARBLER (*Oporornis philadelphia*).—Mr. Spreadborough collected a male specimen on June 4, 1897.

MARYLAND YELLOW-THROAT (*Geothlypis trichas*).—Common summer resident. Arrives about May 24. The form inhabitating this region probably referable to the Northern Yellow-Throat *G. t. brachidactyla.*

WILSON WARBLER (*Wilsonia pusilla*).—Mr. Spreadborough first observed this species at Edmonton on May 29, 1897. A few pairs remained to breed.

CANADIAN WARBLER (*Wilsonia canadensis*).—Mr. Spreadborough did not observe this species anywhere west of Manitoba, except at Edmonton, where he took a male specimen on May 29, 1897.

AMERICAN REDSTART (*Setophaga ruticilla*).—Tolerably common. Arrives the latter end of May. Mr. Spreadborough found them nesting in willow thickets along the streams.

AMERICAN PIPIT (*Anthus pensilvanicus*).—Mr. Spreadborough found this species common at Edmonton from April 27 to May 10, 1897.

CATBIRD (*Galeoscoptes carolinensis*).—Common summer resident. Returns about May 24.

HOUSE WREN (*Troglodytes aedon*).—Common summer resident. Arrives about May 11. The form at Edmonton is referable to the sub-specific one *T. a. parkmanii.*

MARSH WREN (*Telmatodytes palustris*).—A very common summer resident about the sloughs. The nest is completed and the eggs laid by June 5. They have a peculiar habit of building several dummy nests in addition to the genuine one. I once found seven perfectly finished nests within a radius of twenty-five yards. Only one contained eggs, and only one pair of wrens frequented that vicinity. The sub-specific form at Edmonton is placed under *I. p. iliacus.*

WHITE-BREASTED NUTHATCH (*Sitta carolinensis*).—Mr. Atkinson records the species as far west as Edmonton in 1906, the reference being referred to *S. c. nelsoni.*

RED-BREASTED NUTHATCH (*Sitta canadensis*).—Mr. Spreadborough found the species tolerably common at Edmonton in the spruce woods, June 12, 1897.

CHICKADEE (*Penthestes atricapillus*).—Common permanent resident. Former records have been placed under *P. a. septentrionalis.*

HUDSONIAN CHICKADEE (*Penthestes hudsonicus*).— Mr. Spreadborough took a single male specimen on May 7, 1897, which was referred to *P. h. columbianus.*. During my entire time at Edmonton I never once saw this species. I found them as common as the black-capped form near the mountains to the west on the G.T.P. Ry. in 1913.

RUBY-CROWNED KINGLET (*Regulus calendula*).—Tolerably common in the spruce woods. Arrives in early May. The song of this species is surprisingly loud and sweet, considering the diminutive proportions of the bird. I think they breed.

WILSON THRUSH (*Hylocichla fuscescens*).—Very common summer resident. Arrives about May 15. Nest and full set of eggs complete by June 8. Young bor nby June 15. Mr. Taverner informs me that Edmonton specimens submitted to Mr. H. C. Oberholser were referred by him to *salicicola.*

OLIVE-BACKED THRUSH (*Hylocichla ustulata swainsonii*).—Mr. Spreadborough found this species common at Edmonton after May 8, and nests and eggs were taken. Specimens from there, Mr. Taverner informs me, were submitted to Mr. Oberholser for examination and were given the above sub-specific name.

HERMIT THRUSH (*Hylocichla guttata*).—A migrant during May. Specimens from Edmonton were examined by Mr. Oberholser and referred to *H. g. pallasii.*

AMERICAN ROBIN (*Planesticus migratorius*).—Common summer resident. Arrives about April 10.

MOUNTAIN BLUEBIRD (*Sialia arctica*).—Rare at Edmonton. Only once observed, when three individuals in company were frequenting a meadow on September 15, 1902.

SATURDAY AFTERNOON EXCURSIONS.

June 1—Botany; east side of Fairy Lake; meeting-place, the end of the electric car line on the Chelsea road, at 3 p.m.

June 8—General; Black Rapids by steamer Wanekewan; see schedule for the season.

June 15—The Experimental Farm; a selected topic in practical horticulture; meeting-place, The Farm, at 3 p.m.

June 22—Botany; the Beaver Meadow, leading to Fairy Lake, Hull; meeting-place, the end of the city street car line, opposite Eddy Company's office, Hull, at 3 p.m.

OBITUARY.

WILLIAM HAGUE HARRINGTON.

In the death of William Hague Harrington, the Ottawa Field-Naturalists' Club lost one of its oldest members. Mr. Harrington was not only a distinguished entomologist, but he was also a capable botanist, as well as the possessor of a fund of knowledge on natural history generally.

In 1879, Mr. Harrington, with several other naturalists founded the Ottawa Field-Naturalists' Club and was chosen as a member of the Committee. In 1880 he was elected Secretary-Treasurer of the Club. In the following year he was re-elected to the same position and in 1882 the position being divided he was elected Secretary, which office he continued to hold until March, 1885. In that month he was honoured by being elected President of the Club.

At a council meeting of the Club held on March 15 it was resolved as follows:

> "The Council of the Ottawa Field-Naturalists' Club has learned with deep regret of the death on Wednesday, March 13, of Mr. William Hague Harrington, F.R.S.C. Mr. Harrington was known and highly respected by entomologists, botanists and other scientific men not only in Canada but throughout the United States as well. His studies, particularly on certain families of insects had given him a wide reputation, and in his death the science of entomology particularly has lost a devoted worker. As a former Secretary and Past President of the Club he was held in high regard by our members."

Mr. Harrington was born at Sydney, Cape Breton, N.S., on April 19, 1852; he was thus almost 66 years old when he died. In 1870, he came to Ottawa and entered the Post Office Department. Here his ability was soon recognized and from one promotion to another he was in 1908 appointed Superintendent of the Savings Bank Branch, an important position in the above department. In June, 1916, after 45 years of public service he was granted superannuation and being thus relieved of official duties he looked forward to being able to devote himself more fully to entomological studies. Unfortunately, however, this was not to be. More recently, particularly during the past two years a continued anaemic condition gradually undermined his system. Last November his condition became decidedly more serious and he was compelled to take to his bed. About that time too, he had a slight paralytic stroke. During the past winter, paralysis increased gradually and this with profound anaemia finally caused death.

A more extended notice will appear in the June, 1918, issue of *The Canadian Entomologist.*

A. G.

ROBERT B. WHYTE.

In the sudden passing of Mr. R. B. Whyte, on April 15, 1918, Ottawa lost one of her most useful and respected citizens. He stood for all that was highest in the life of the city and the nation. He scorned all that was mean, dishonest and low. His aspirations were of the noblest and the best in everything. What he accomplished is recorded in many ways, and not the least in the hearts of those who knew him best. The influence of the good which he did during his life will last for many a day. Old men and little children praise him. He was the greatest amateur horticulturist of his time in Canada.

True lovers of nature are born, not made. From his early youth the late R. B. Whyte was interested in wild flowers and, in fact, in all branches of natural history, and though at an early age he was obliged to spend long days in his father's business, he managed to get some time in which to study plants. His largest collection of wild flowers was made in 1875, but each year he searched the woods diligently about Ottawa for new things, and his herbarium at length contained most of the species found in the Ottawa district. When the Ottawa Field-Naturalists' Club was formed in 1879 he was one of the charter members and the first Secretary of the club. He was President in 1888-89, a member of the council for many years, and was always an active member of the club. He received much inspiration in those days from the late Dr. James Fletcher with whom he was closely associated.

His health began to fail about five years ago, and although he could not take as much physical exercise as in former years, his brain was just as active and his interest in everything as great up to his sudden death from over exertion in his garden. He was sixty-seven years of age when he died and his wife, two sons and five daughters are left to mourn his loss, besides a host of friends.

W. T. M.

BIRD NOTES FROM MANITOBA.

BY NORMAN CRIDDLE, TREESBANK, MAN.

THE ARKANSAS KINGBIRD.

The breeding range of the Arkansas Kingbird, *Tyrannus verticalis*, is usually given as Western United States, Southern Saskatchewan, Alberta and British Columbia. It has also been recorded as breeding at Pilot Mound, Man., by Dr. H. M. Speechly and at Treesbank, Man., by the writer. Since the above observations were made the bird has been met with in other localities, which would seem to indicate that it is not as rare in the province as was previously supposed. A pair

were found breeding among some maples near Oak Bluff, fourteen miles south-west of Winnipeg, Man., in 1917. A second couple have nested near Treesbank for some years past, and a third breeding pair were observed near Stockton. At Souris, Man., which borders the prairie country, no less than seven pairs were inhabitants of the village. Observations made around their nesting grounds indicates that the species is less pugnacious than its better known ally the Kingbird. It is also less conspicuous on account of its habit of resting more among the trees instead of on top of them. Both species breed in very similar situations and have been found inhabiting the trees at opposite ends of gardens. Naturally birds with homes so close together and natures not too amiable, are apt to resent each other's presence, hence there is a perpetual squabble which seems to be especially fostered by the Kingbird. Many combats take place in consequence, which as a rule are decided in favour of the Kingbird, unless this species attempts to invade the other's home, when the tables are turned.

The Arkansas Kingbird, like its rival, is somewhat noisy, but its notes constitute more of a continuous twitter without any of the loud harsher cries of defiance so characteristic of the Kingbird. There is every reason to suspect that a better knowledge of the species will show that it breeds in the shelter belts of many gardens within the province, as it seems to prefer the haunts of man to those strictly natural.

THE BLACK-THROATED BLUE WARBLER IN MANITOBA.

The writer recorded this species *(Dendroica caerulescens)* from Aweme in THE OTTAWA NATURALIST some years ago, but the record was questioned in Macoun's List of Canadian Birds. This Warbler is among the easiest to identify on account of its unusual markings, which makes it difficult to confuse with any other. The observing of an old male on September 13, 1917, at close range should be sufficient to establish the bird's right to a place on our lists. Both examples were met with in the same woodlot at Aweme, Man.

NOTE.

It is perhaps characteristic of the west that the first Museum to obtain from the post-office department the right to have its bulletin mailed to soldiers by the simple means of affixing a one-cent stamp to the cover, should have been the Chicago Art Institute. The idea is an excellent one. Some of our museum bulletins are much more interesting to the average reader than others, yet there are few that would not have an interest for a soldier from the town in which it was published. It is to be hoped that the example of Chicago will soon be followed by other museums.

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